Air Force Materiel Command

OTB Discussion

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HQ AFMC/EN
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The material was assigned a clearance of CLEARED on 06 Jun 2016.

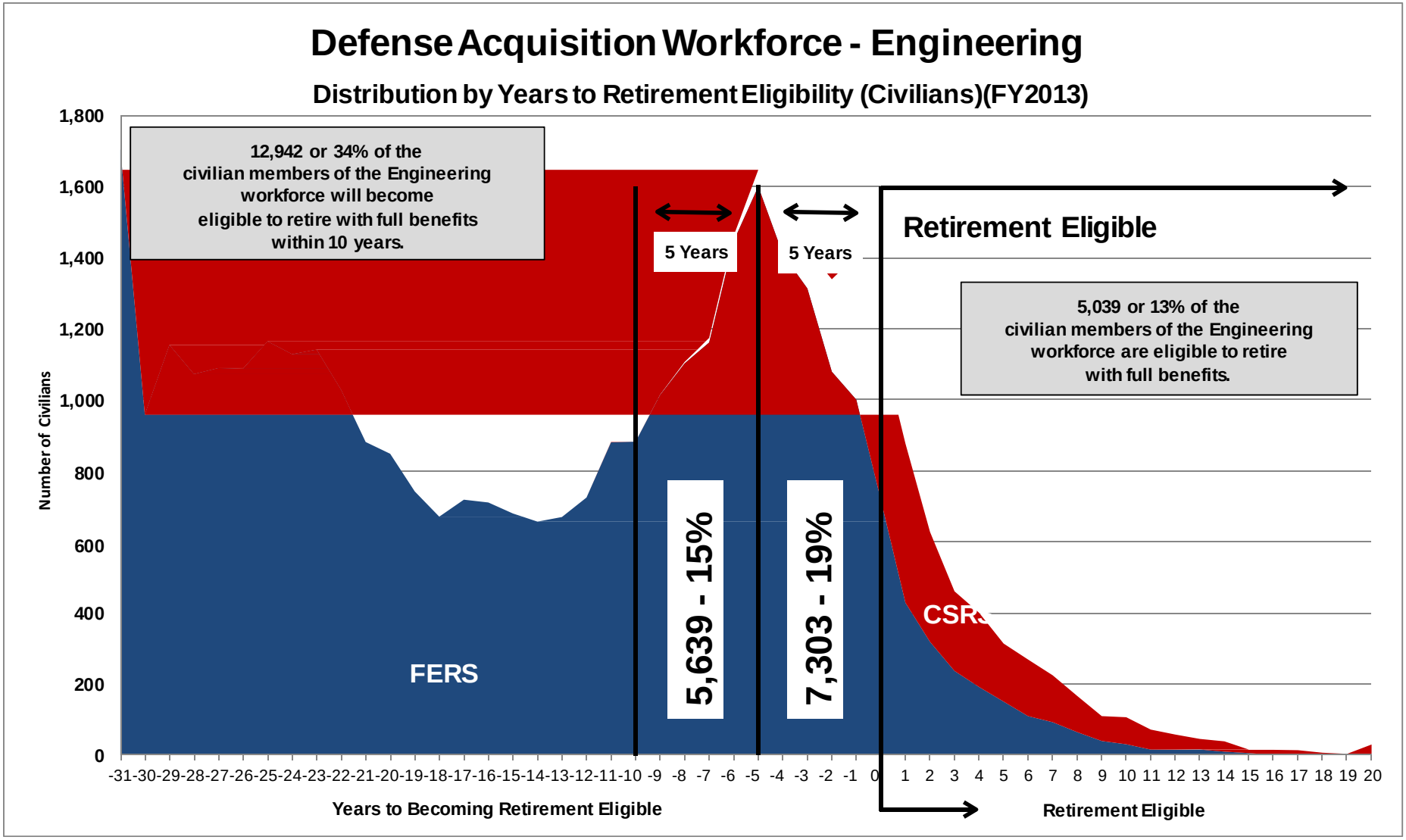
How Did We Get Here?

- **DoD Engineering Viewed as Insufficient to Meet Current Requirements**
  - **Acquisition and sustainment problems (C/S/P) attributed in large part to engineering**
- **Senior Leadership Calling for Improvements**
  - **SECAF "Go Fix Engineering" (2013)**

Why the Need to "Fix Engineering"?

- **1980's**
  - **System complexity and demand for "acquisition speed"**
  - **SPOs populated with broad set of technical disciplines, but Systems Engineering disciplines considered lacking**
- **1990's**
  - **System complexity and demand for "acquisition speed" increase**
  - **TSPR seen as possible solution, but results in smaller SPOs with deteriorating engineering capabilities**
  - **Systems Engineering emphasis and training bolstered, but does not address broader requirements for engineering disciplines**
- **Early 2000's**
  - **AFMC transitions to "Wings/Groups/Squadrons**
    - Unintended consequence: Tie/Mentoring between SPO engineers and Home Office "grey beards" suffers; Engineering capability further deteriorates

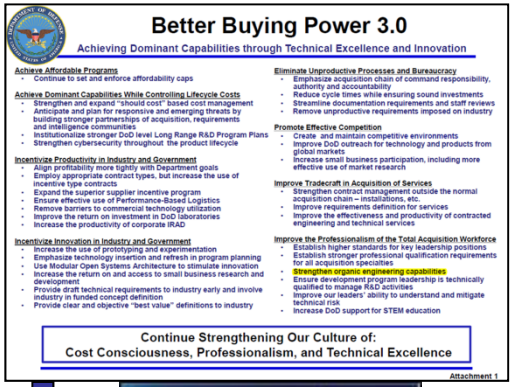
FY 2013 Engineering Workforce Distribution by Years to Retirement Eligibility



Strategic Guidance

AF Strategic Planning

… a requirements process and acquisition system that accommodates more frequent "pivot points" – opportunities to modify or abandon a program during its life cycle – and harnesses rapid prototyping …



Better Buying Power 3.0

Achieving Dominant Capabilities through Technical Excellence and Innovation

Achieve Affordable Programs
- Continue to set and enforce affordability caps

Achieve Dominant Capabilities While Controlling Lifecycle Costs
- Strengthen and expand "should cost" based cost management
- Anticipate and plan for responsive and emerging threats by building stronger partnerships of acquisition, requirements and intelligence communities
- Institutionalize stronger DoD level Long Range R&D Program Plans
- Strengthen cybersecurity throughout the product lifecycle

Incentivize Productivity in Industry and Government
- Align profitability more tightly with Department goals
- Employ appropriate contract types, but increase the use of incentive type contracts
- Expand the superior supplier incentive program
- Ensure effective use of Performance-Based Logistics
- Remove barriers to commercial technology utilization
- Improve the return on investment in DoD laboratories
- Increase the productivity of corporate IRAD

Incentivize Innovation in Industry and Government
- Increase the use of prototyping and experimentation
- Emphasize technology insertion and refresh in program planning
- Use Modular Open Systems Architecture to stimulate innovation
- Increase the return on and access to small business research and development
- Provide draft technical requirements to industry early and involve industry in funded concept definition
- Provide clear and objective "best value" definitions to industry

Eliminate Unproductive Processes and Bureaucracy
- Emphasize acquisition chain of command responsibility, authority and accountability
- Reduce cycle times while ensuring sound investments
- Streamline documentation requirements and staff reviews
- Remove unproductive requirements imposed on industry

Promote Effective Competition
- Create and maintain competitive environments
- Improve DoD outreach for technology and products from global markets
- Increase small business participation, including more effective use of market research

Improve Tradecraft in Acquisition of Services
- Strengthen contract management outside the normal acquisition chain – installations, etc.
- Improve requirements definition for services
- Improve the effectiveness and productivity of contracted engineering and technical services

Improve the Professionalism of the Total Acquisition Workforce
- Establish higher standards for key leadership positions
- Establish stronger professional qualification requirements for all acquisition specialties
- Strengthen organic engineering capabilities
- Ensure development program leadership is technically qualified to manage R&D activities
- Improve our leaders' ability to understand and mitigate technical risk
- Increase DoD support for STEM education

Continue Strengthening Our Culture of:
Cost Consciousness, Professionalism, and Technical Excellence

Attachment 1

Achieve Dominant Capabilities while Controlling Lifecycle Costs
Increase the use of prototyping and experimentation
Improve Requirements Definition
Strengthen Organic Engineering Capability
Improve our leaders ability to understand and mitigate technical risk

Priority 1: Refine engineering enterprise governance, roles and responsibilities, and supporting policy
Priority 2: Enable high-quality engineering decisions and seamless comms
Priority 3: Improve engineering discipline through technical information management and standardization
Priority 4: Address engineering enterprise workforce issues, including core competencies, structure, development, and assignment

SAF/AQ
Own the Technical Baseline

On-going Efforts

- AF Engineering Enterprise Executive Council (AQR, AFMC, AFSPC)
- BBP 3.0 “Strengthen Organic Engineering Capabilities” (AT&L)
- Digital Thread/Digital Twin/Digital System Model (DASD(SE), AFMC)
- Cost Capability Analysis (HAF, AFMC, AFLCMC)
- CREATE (AFMC, AFLCMC, AFRL, Navy, Army, DoD)
- AF Strategic Development Planning (HAF, AFRL, AFLCMC)
- LogIT Capability Initiatives (AFMC/A4, PEO BES)
- CBM+P (AFLCMC/EZP)
- Additive Manufacturing (AFLCMC/EZP, AFRL/RX)
- Engineering Resilient Systems (ASD (R&E), ERDC)
- Open Mission Systems (RCO, AFLCMC, AFRL)
- M&S Council of Colonels (HAF, AFLCMC, AFRL, AFMC, AFSPC)
- Industry Involvement – DTWG, AMMO, JTEG, DMDII, America Makes, NDIA Systems Engineering Division M&S Committee
- Own the Technical Baseline (SAF/AQ)

What Are We Doing?

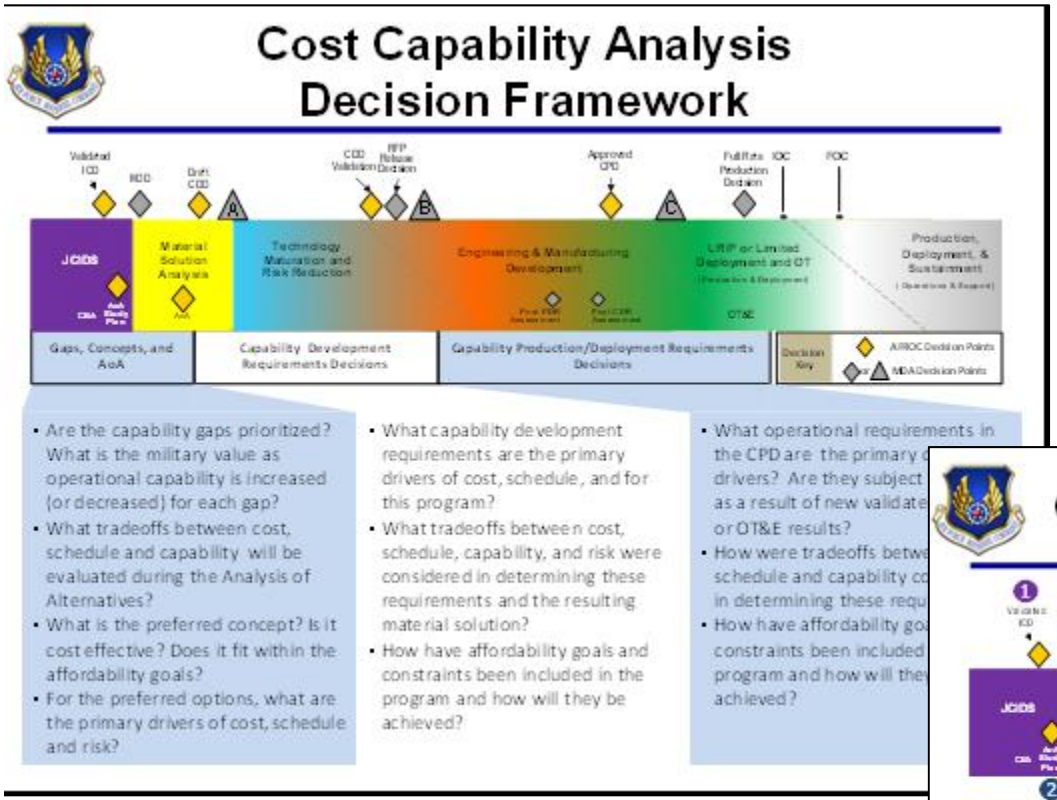
- **AF Engineering Enterprise Strategic Plan and Roadmap**
  - **10-Year Plan, Kicked off 2013**
  - **4 Priorities, 10 Goals, 57 Objectives**

Engineering Enterprise Strategic Plan

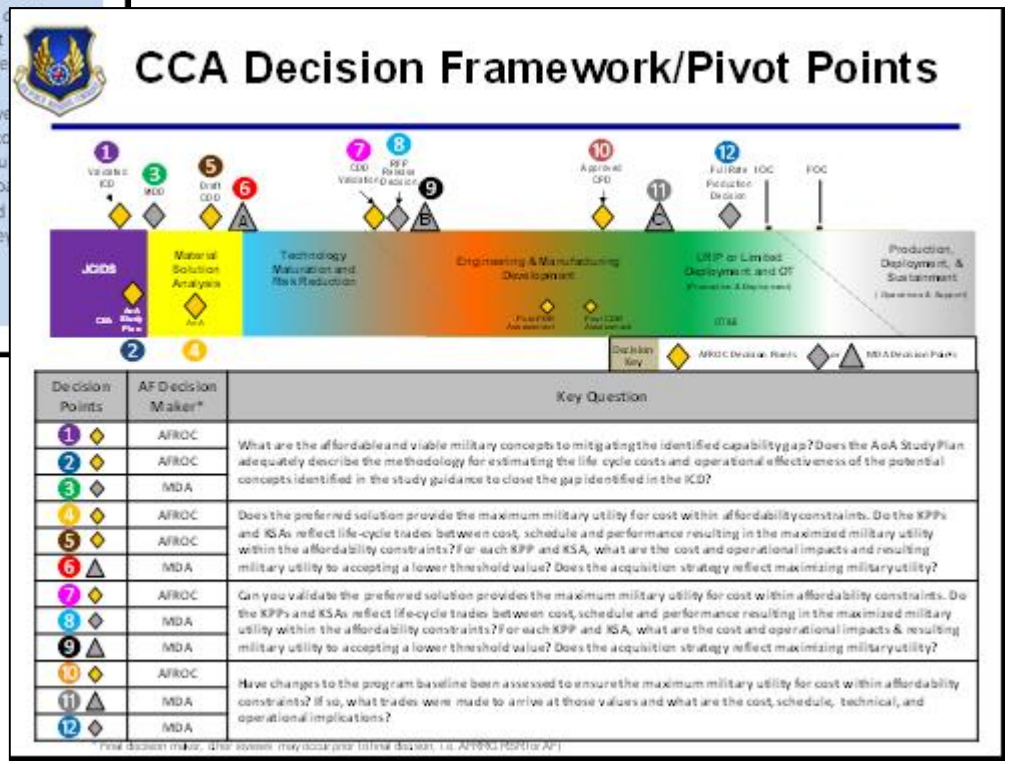
- **Priority 1: Refine engineering enterprise governance, roles and responsibilities, and supporting policy**
- **Priority 2: Enable high-quality engineering decisions and seamless communications**
- **Priority 3: Improve engineering discipline through technical information management and standardization**
- **Priority 4: Address engineering enterprise workforce issues, including core competencies, structure, development, and assignment**

Cost Capability Analysis

Priority 1 and 2



- CCA Decision Framework
  - Applied across lifecycle
  - Expectations at each phase

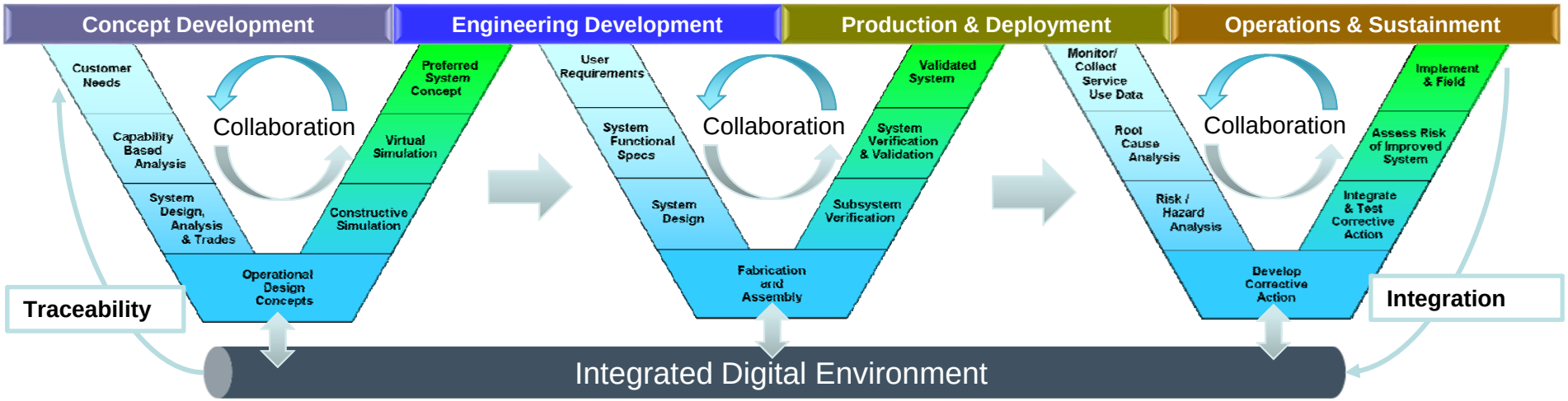


- CCA Decision Framework/Pivot Points
  - 12 Points across lifecycle
  - 6 Prior to MS A
  - Detailed expectations at each point
- CCA Standard Process in AFLCMC
  - Adopted by AFNWC
  - Working with SMC

MBSE Across the Lifecycle

Priority 2 and 3

- **An integrated approach to MBSE maintains information throughout the product lifecycle – Gap Identification through Disposal – Enabling <u>Own the Technical Baseline</u>**



Digital Thread is the *<u>KEY</u>* Enabler

What is a Digital Thread?

"An extensible, configurable and component enterprise-level

analytical framework

that seamlessly expedites the controlled interplay of

authoritative technical data, software, information, and knowledge

in the enterprise data-information-knowledge systems, based on the Digital System Model template, to inform decision makers throughout a system's life cycle by providing the capability to access, integrate and transform disparate data into actionable information."

(source: DAU Glossary of Defense Acquisition Acronyms and Terms)

Digital Thread is **NOT** limited to manufacturing

What is a Digital Twin?

"An integrated multiphysics, multiscale, probabilistic

***simulation of an as-built system*,**

***enabled by Digital Thread*,**

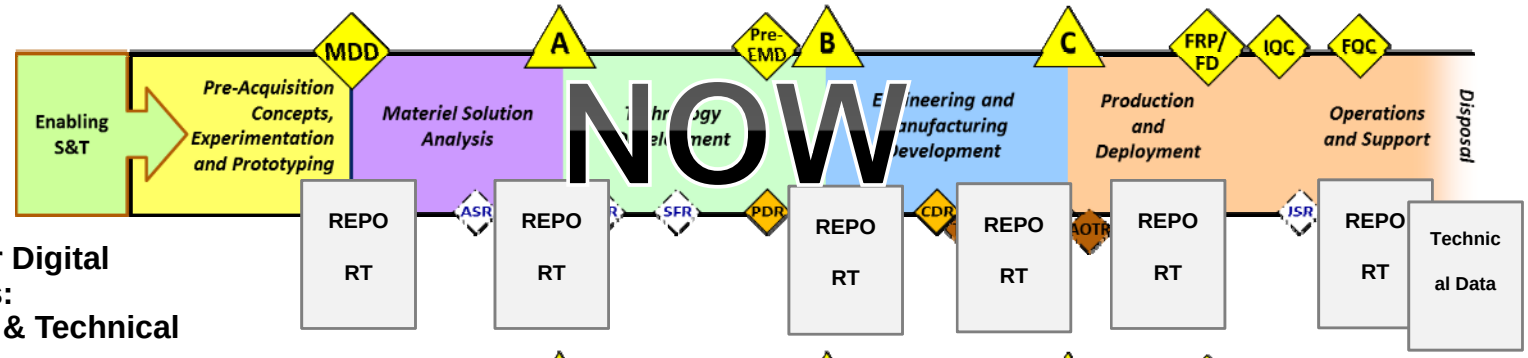
that uses the best available models, sensor information, and input data to mirror and predict activities/ performance over the life of its corresponding physical twin."

(source: DAU Glossary of Defense Acquisition Acronyms and Terms)

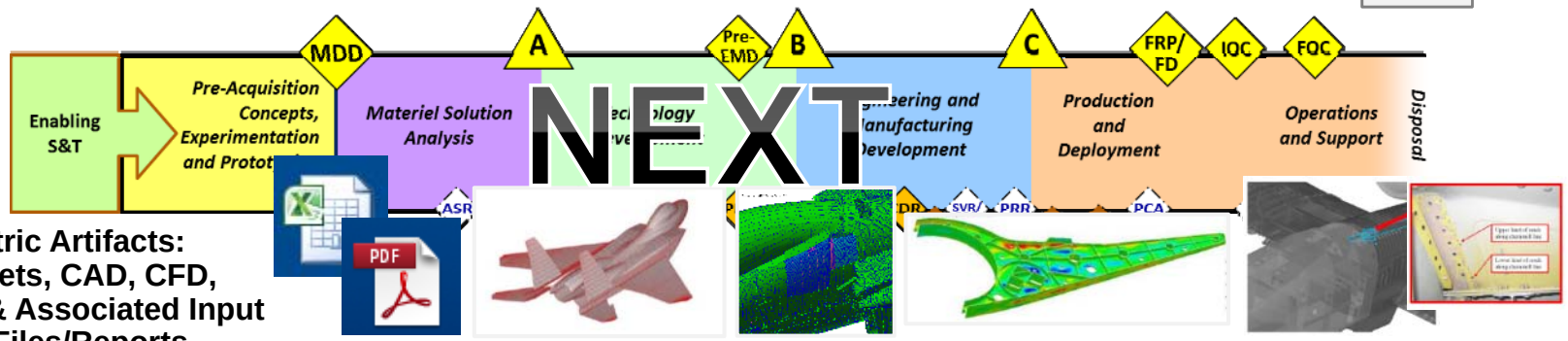
A Digital Twin is **NOT:**

- a Digital Tool for Configuration Management
- a 3D Geometric Model of an As-Built System
- a Model-based Definition of an As-Built System

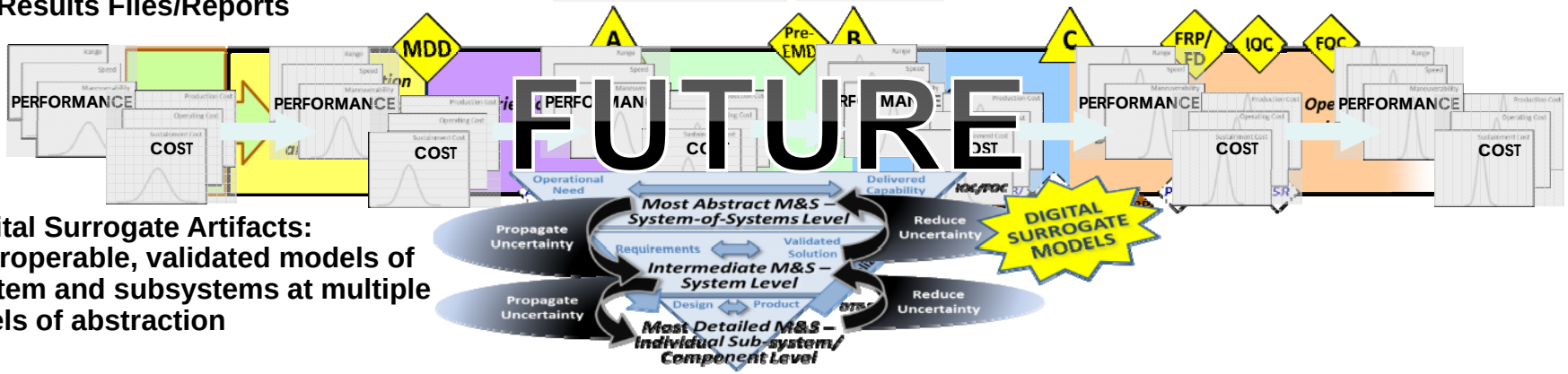
The DT Revolution: From Digital Artifacts to Model-centric Engineering and Beyond



Paper or Digital Artifacts: Reports & Technical Data



Model-centric Artifacts: Spreadsheets, CAD, CFD, FEM, etc. & Associated Input & Results Files/Reports



Digital Surrogate Artifacts: Interoperable, validated models of system and subsystems at multiple levels of abstraction

Own the Technical Baseline!

Own the Technical Baseline

- **Owning the Technical Baseline**
  - **Technical Baseline – Data and information that provides the program office knowledge to establish, trade-off, verify, change, accept, & sustain functional capabilities, design characteristics, affordability, schedule, and quantified performance parameters at the chosen level of the system hierarchy**
  - **"Ownership" of the Technical Baseline – The government applies technical baseline knowledge to be an informed decision maker and to go "toe-to-toe" with Industry counterparts**
- **What do we need to OTB?**
  1. **Access to Engineering Data**
  2. **Competent Experts**
  3. **Engineering Analytic Capability**

Access to Engineering Data

Priority 2 & 3

- **BBP 3.0 "Strengthen Organic Engineering Capability"**
  - **<u>Focus Area 3: Analysis Capability</u>** ***Desired End-State*****: A framework which enables informed decision making, tool interoperability, best practices, training, and authoritative data reuse across the DoD enterprise and industry; resulting in stronger organic engineering capabilities**
  - **Executed through EEEC Priority 2**
- **AFMC/MITRE Sprint I, II**
  - **Sprint I: Define use cases for the first 6 decision points, capture information elements (what and who) and relate to PPBE process, map information elements to EEEC priorities – outbrief 18 May**
  - **Sprint II: Determine the data and associated suite of tools to be supplied to the AF engineering workforce to support architecture, engineering and analysis over a system's lifecycle**
- **SAF/AQ, SAF/GC and Industry Data Rights working group to determine what and how**

Access to Engineering Data

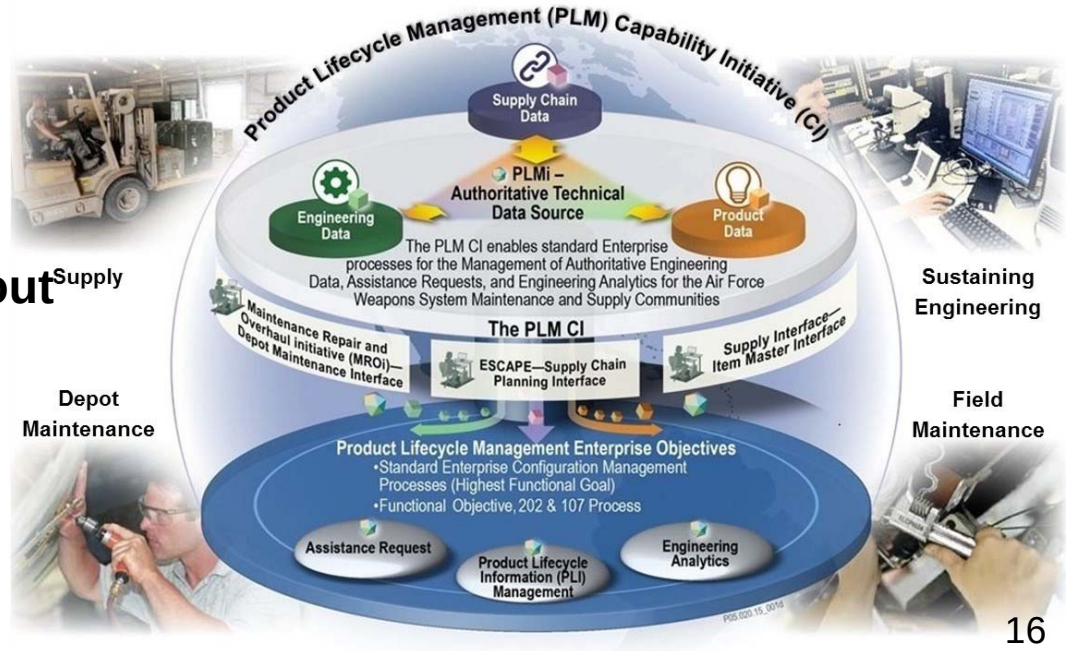
Priority 2 & 3

PLM-CI Vision

PLM-CI provides the USAF a single comprehensive enterprise capability to manage all program data and business processes from gap identification through disposal

- **Requirements**
- **Analysis Data**
- **Test Data**
- **RAM-C Data**
- **PLI**

Linked throughout the lifecycle



Competent Experts

Priority 4

- **BBP 3.0 "Strengthen Organic Engineering Capability"**
  - **<u>Focus Area 2: Competency/Technical Expertise Management</u> *Desired End State*: Documented set of competencies each with specific criteria with verified proficiency-levels fully-characterized technical workforce according to these competencies. Documented talent management process, showing typical assignments, training, education, and experiences necessary to grow proficiency in specified areas of expertise and actively managed gaps / risks**
  - **Executed through EEEC Priority 4**

Competent Experts

Priority 4

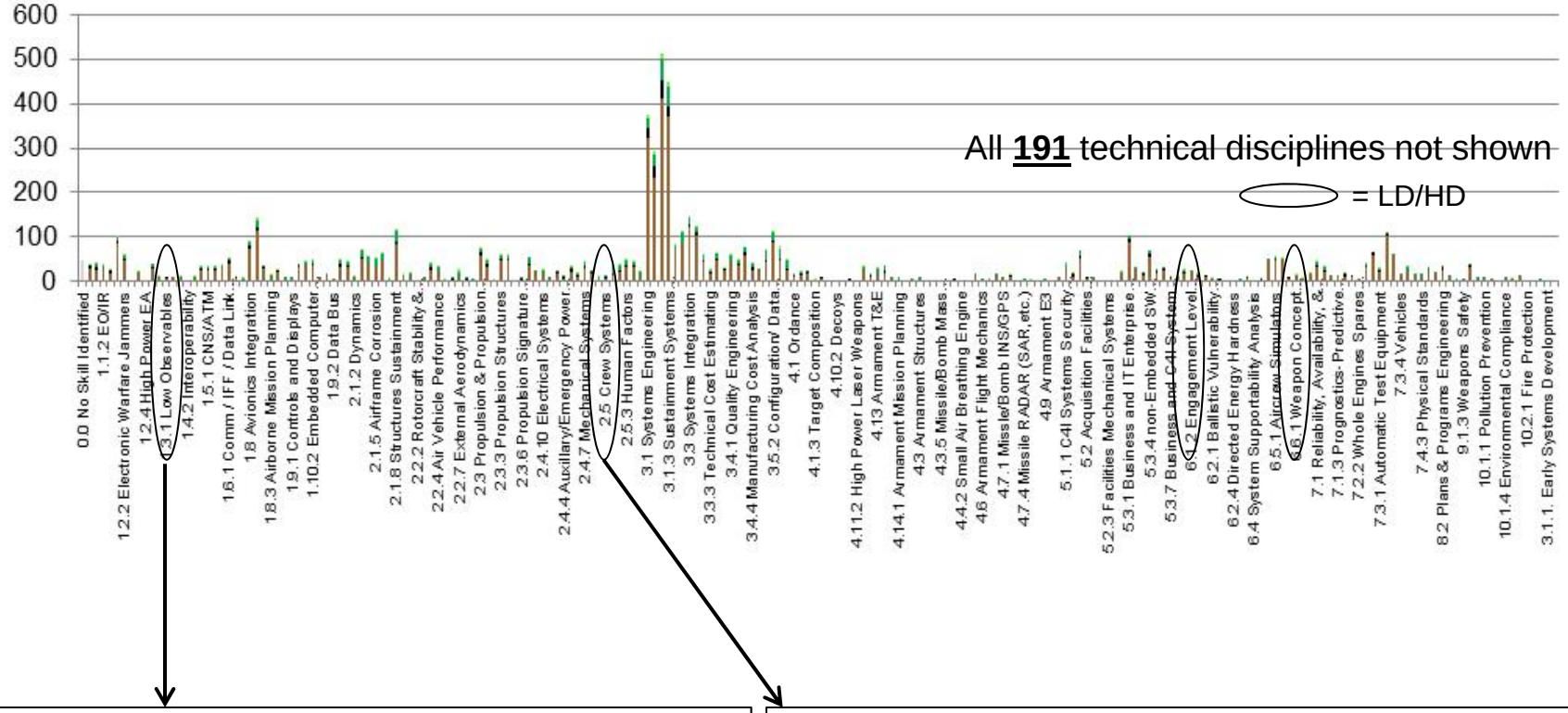
- **Understand all technical disciplines required to develop and sustain our systems & manage those technical disciplines aligned to your functional**
  - **Including those provided by military, A&AS and FFRDC**
- **Understand the gaps between supply & demand of our technical disciplines**
  - **Implies supply and demand is documented (accurate database) and gap analysis is current**
- **Mitigate the gaps**
  - **Organic workforce development (education, training, rotations, deliberate succession planning, hiring, etc)**
  - **Targeted A&AS & FFRDC support**
- **Influence organization/re-organization and process improvement decisions based on workforce competency data (facts)**

Essential to Meeting the Diverse Technical Needs of our Complex Acquisition & Sustainment Portfolio

Competent Experts

Priority 4

Examples of Low Density, High Demand Disciplines (22 Total)



Low Observables Competency 1.3

LD/HD > 1.3.1 Low Observables Discipline

Crew Systems Competency 2.5

LD/HD > 2.5.1 Aircraft Escape Systems
2.5.2 Aircraft Crew Station
2.5.3 Aircraft Human Factors
LD/HD > 2.5.4 Aircraft Life Support Systems
2.5.5 Air Transportability, Airdrop

Engineering Analytic Capability

Priority 2 & 3

- **BBP 3.0 "Strengthen Organic Engineering Capability"**
  - **<u>Focus Area 3: Analysis Capability</u>** ***Desired End-State*****: A framework which enables informed decision making, tool interoperability, best practices, training, and authoritative data reuse across the DoD enterprise and industry; resulting in stronger organic engineering capabilities**
  - **Executed through EEEC Priority 2 & 3**
- **Engineering Tools**
  - **Standard Desktop Solution**
    - Installed
    - Web access – AFSERC (AF Systems Engineering Resource Center)
  - **Discipline Specific Solutions in High-Power Labs**

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NSERC Engineering Tool Applications

DOORS	RHAPSODY	MINITAB	METHOD COMPOSER
DOORS TRACELINE	MAGIC DRAW	WEIBULL++	TEAM CONCERT
SYNERGY	OPUS SUITE	ALTA PRO	QUALITY MANAGER
CHANGE	ENTERPRISE ARCHITECT	DOE	REQUIREMENTS COMPOSER
SYSTEM ARCHITECT	MATLAB	RENO	DOORS NEXT GEN
SOFTWARE ARCHITECT	IGRAFX	XFMEA	DESIGN MANAGEMENT
ASSET MANAGER	XFRACAS	RCM++	RISK EXCHANGE +
INNOSLATE	RGA	LAMBA PREDICT	MDCONNECT
CORE	BLOCKSIM	PUBLISHING ENGINE	DESIGN EXPERT

= IBM Rational (Token)

= In discussion

= Stand alone licenses

Many of the applications have multiple plugins to provide expanded capability

AF Systems Engineering Resource Center (AFSERC)

- **AFLCMC PEO's funded AFLCMC/EN-EZ to stand up AF version of NSERC**
  - **NSERC provides SE, Analysis and Reliability tools to the Navy**
    - Unclassified and SIPR environments provided
    - Accessed via Citrix
    - Accredited through Navy AO until Feb 2019
  - **Leverages Navy licensing agreements, virtualized infrastructure & help desk**
- **AF to provide a baseline capability**
  - **PMO responsible for costs related to baseline deviations**
    - Tools outside of the baseline
    - Customized services
  - **Negotiating with AQR for training funding**
    - On site Beginning, Intermediate and Advanced
    - PMO consultation/assistance
- **SLA currently being negotiated w/Navy**
- **IOC expected Dec '16 (hopefully sooner)**

Tools Funding Request

Priority 2 & 3

- **Standard Desktop Applications**
  - **Procure with DAWDF/PEO, POM Mx Fees**
  - **SE Tools, Reliability, Visualization, MATLAB, Specs & Standards**
- **Discipline Specific Applications**
  - **Procure with DAWDF, POM Mx Fees**
  - **CREATE-AV/SENTRi, CAD, FEA, CFD, Simulation, etc.**
- **Training**
- **Hardware Refresh**
- **A&AS**
  - **AW Assessments, SETR Independent Review, Engineering Lab support**

OTB Metrics

- **How will we measure OTB?**
  1. **Workforce metric**
     - Authorized and Assigned
     - Skills available and Skills required
  2. **OTB attributes metrics**
     - Pre MDD
     - MS A
     - TMRR
     - Post MS B

OTB Workforce Metric

Program	Total Rqmt/Filled	Govt Civ Auth/Filled	Govt Other Auth/Filled	Technical Skill Gaps	Mitigation Strategy
Program 1	31/21	5/5	26/16	▪ Sustainment ▪ Reliability ▪ Production	FFRDC and A&AS

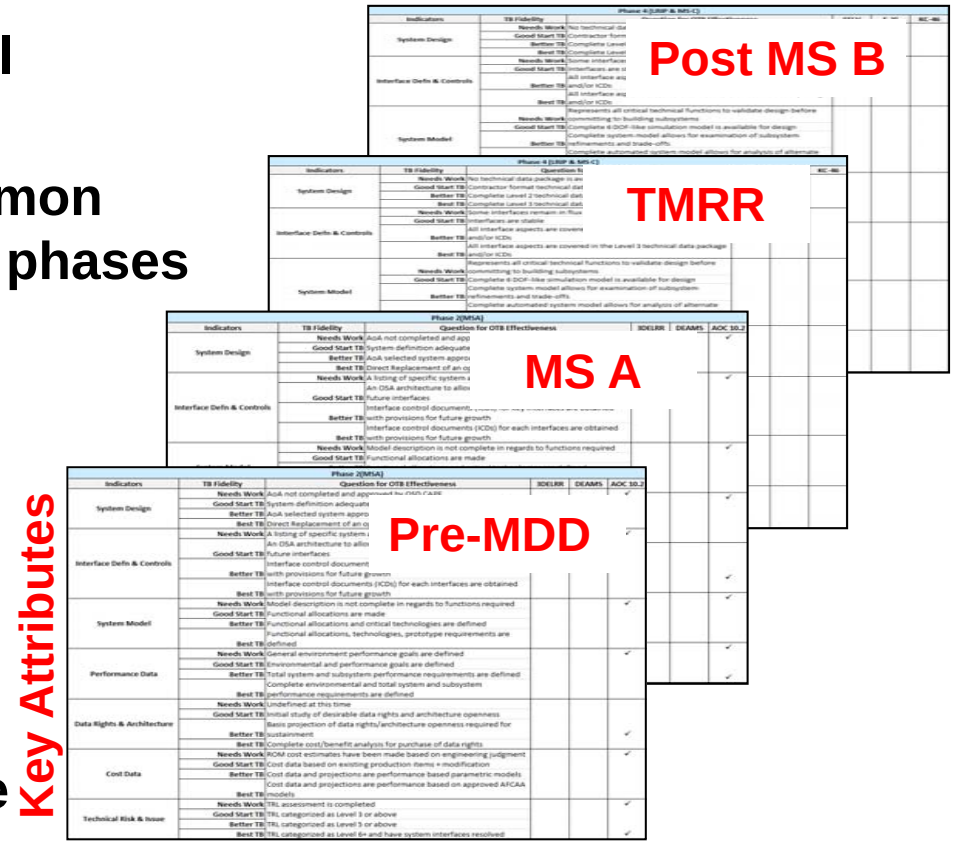
- **ONLY technical staff is being measured**
- **Total required and filled are gov't civilian + military + contractor**
- **Gov't Civilian are full time civilians authorized (UMD) and filled**
- **Gov't other are military and A&AS/FFRDC authorized and filled**
- **List skill gaps and mitigation strategy**

OTB Construct

Program Phase + Key Attributes

Program	System Design	Interface Defn & Controls	System Model	Performance Data	Data Rights & Architecture	Cost Data	Tech risk & Issues
Program 1	✓	✓	✓	✓	Good Start	✓	✓

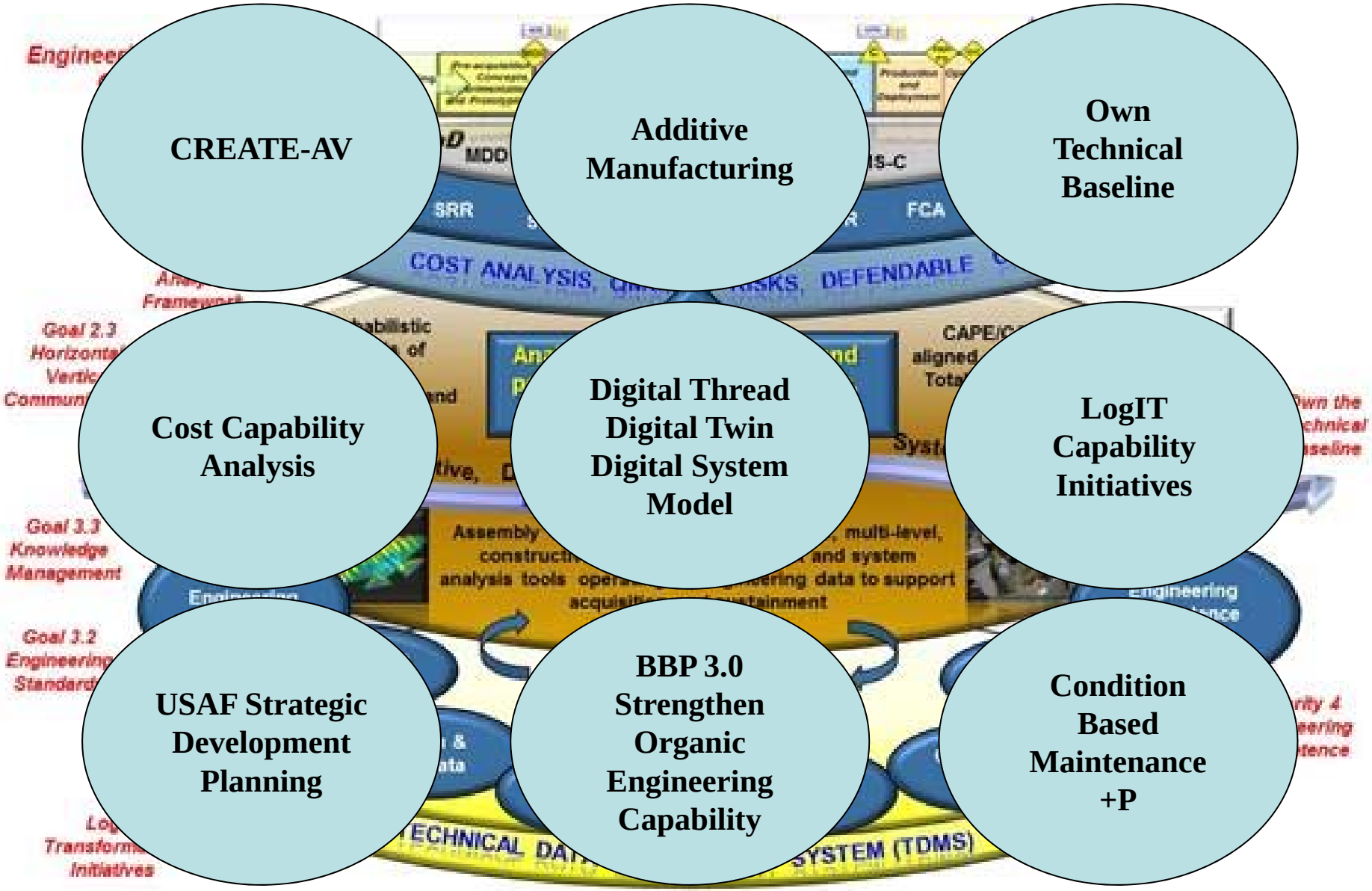
- OTB ownership is a continuing process
- Programs are in different technical development phases
- The OTB "key attributes" are common across the technical development phases
- The combined OTB "key attributes" with phases of technical development provides a construct to measure extent of "ownership"
- OTB ownership is a continuous process with increased fidelity as a program progresses through the technical development phases



OTB Standard Attributes

1. System Design – includes Requirements, CONOPs, WBS, Config Baseline documentation (Functional/Allocated/Product), TDP (as appropriate), System/Sub-System Specs, Change Management Process(es), technical/system descriptions to support costing and acquisition
2. Interface Controls – includes ICDs, Internal & External Interfaces, Hardware & Software Interfaces, Change Management Process(es)
3. End-to-End System model and ability to exercise it – includes both static & dynamic system/sub-system modeling and simulation tools; M&S algorithms and/or CONOPs; evolved over time (digital thread)
4. Development and Operational Performance Data – DT & OT Test Plans/Data/Reports; System Integrity Programs/Data/Reports
5. Data rights and open architectures – includes the level(s) of data rights needed/acquired/enforced, architecture standard(s) needed/acquired/enforced, identification of proprietary items
6. Cost Data – includes Estimates (methods, algorithms, etc.), Actuals, Cost vs Performance Tradeoffs, CAIV, BCAs, Earned Value Mgmt, Value Engineering, WBS
7. Technical Risks & Issues – includes structured identification & monitoring and mitigation; review and reporting mechanisms; root cause and corrective action plans

Let’s Connect the Dots



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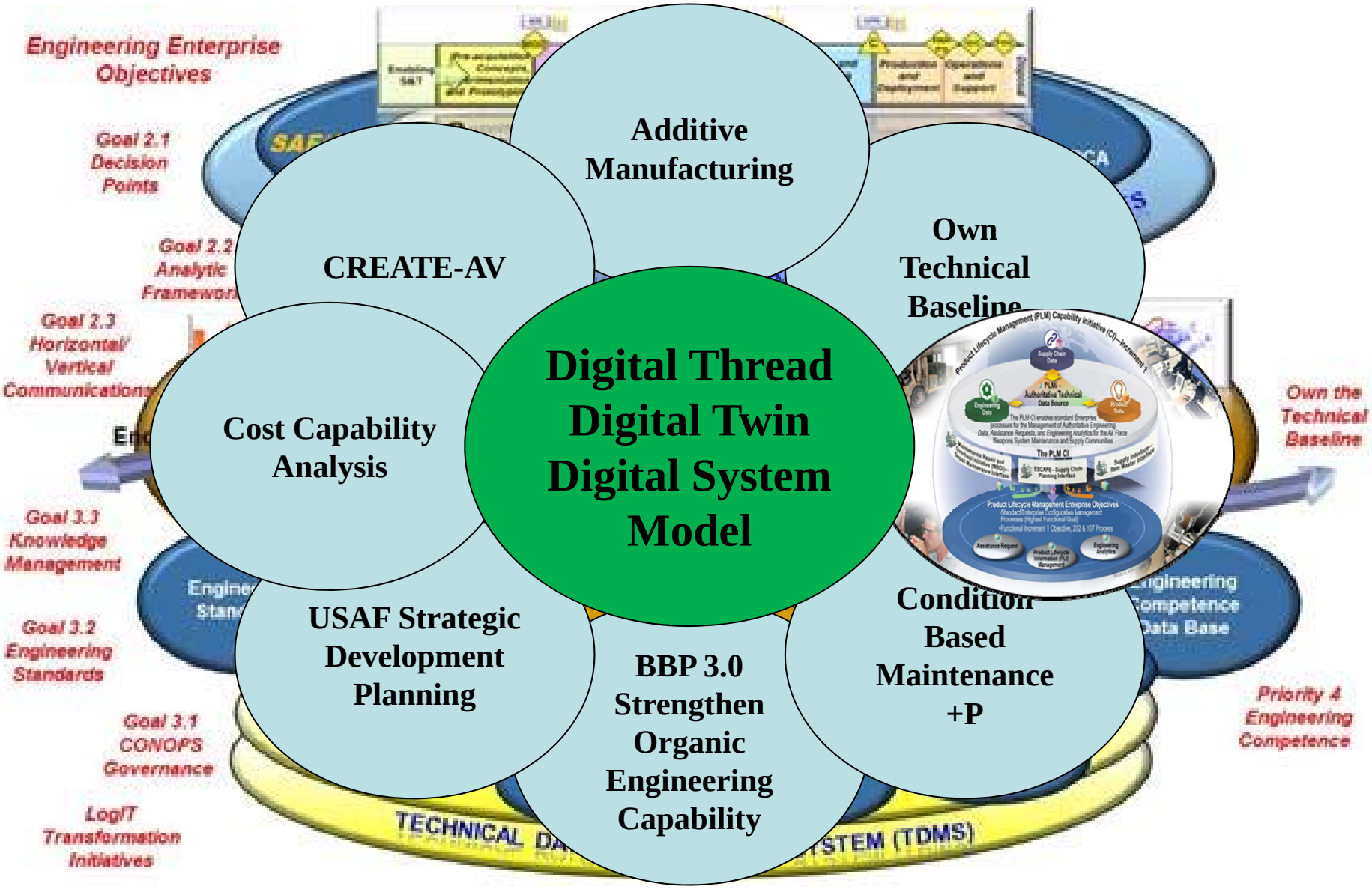

Summary

- OTB is just one of many complimentary initiatives
- We are going to restore organic engineering capability
  - Access to the right data across the life cycle
  - Access to the right analytic tools across the life cycle
  - Access to the right training at the right time

AIR FORCE MATERIEL COMMAND