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Air Force Use of Digital Models to Connect Requirements to System Definitions and Behavior

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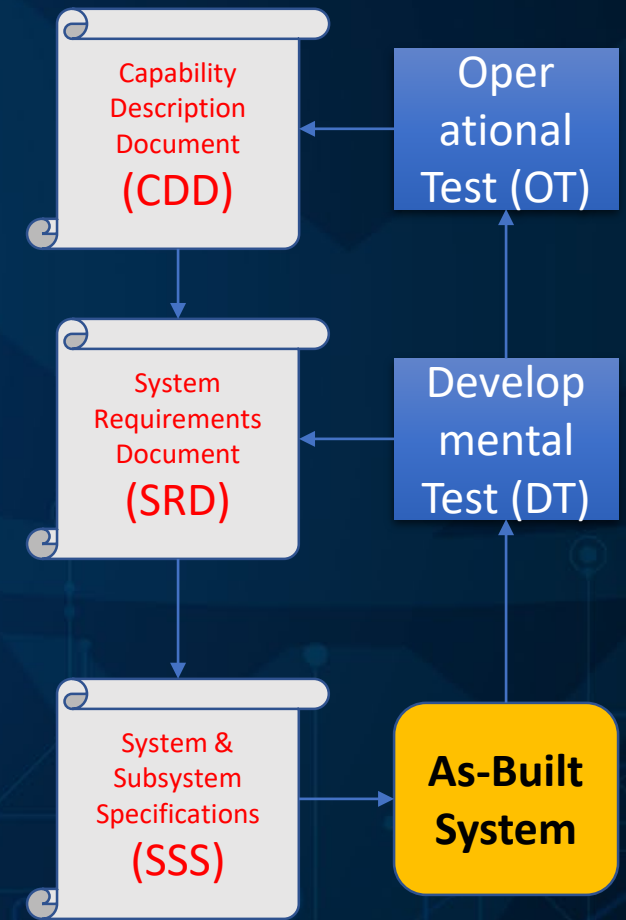
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Historical Tie of USAF Requirements, System Design and Verification

1. Capability gap identified by operational MAJCOMs and/or USAF leadership – Capability Based Assessment (CBA)
2. Analysis conducted to determine extent of gap and if a new Material solution is needed
3. Requirements for new Material solution captured in Word document called capability description document (CDD)
4. Acquisition program office receives direction to procure, funding and CDD
5. Program office creates derived system requirements document (SRD) and places on contract to vendor
6. Vendor designs system and creates detailed system and subsystem specifications (SSS) for fabrication
7. Developmental Tests conducted to verify vendor satisfied the SRD
8. Operational Tests conducted to ensure system solves capability gap (CDD)

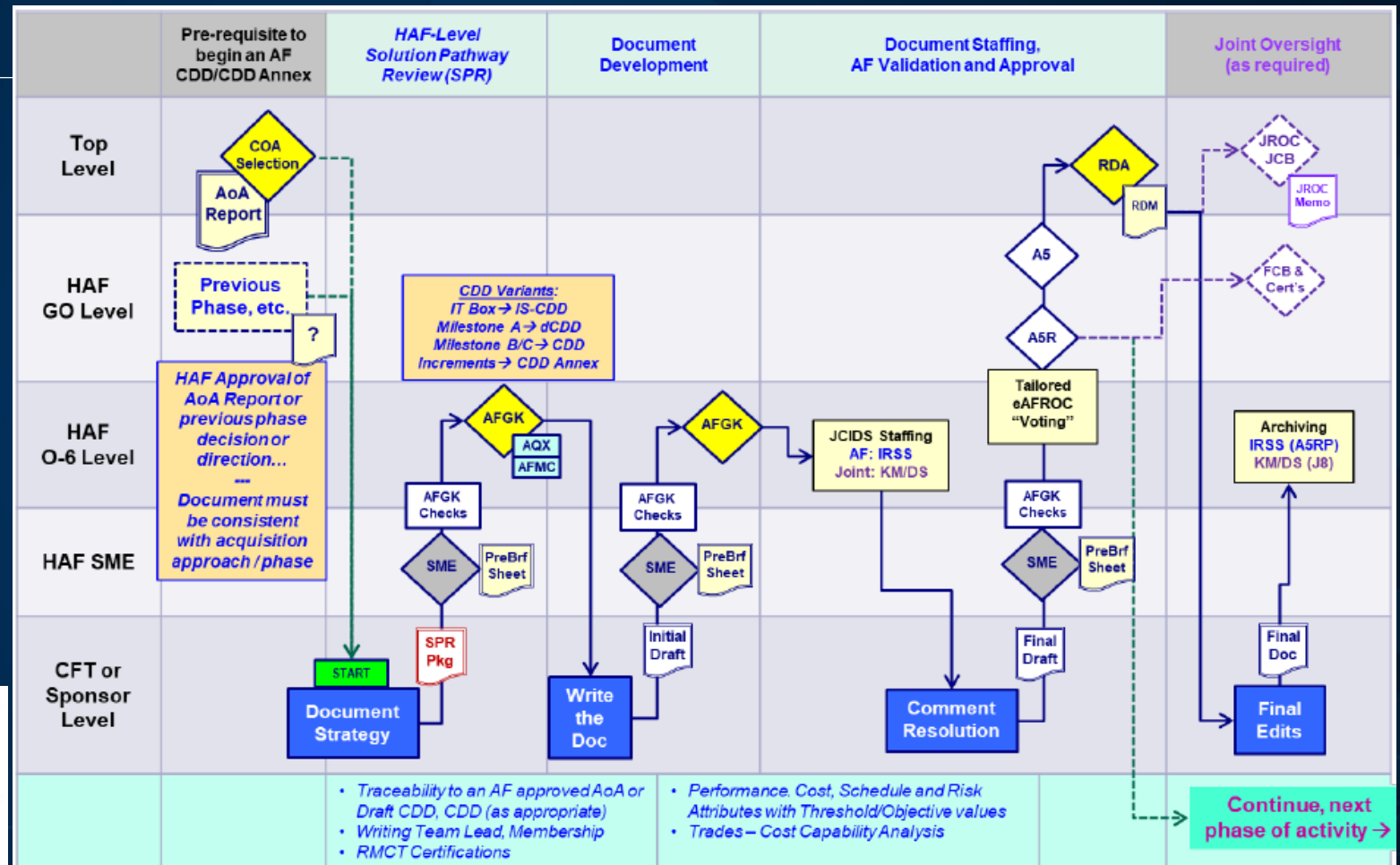
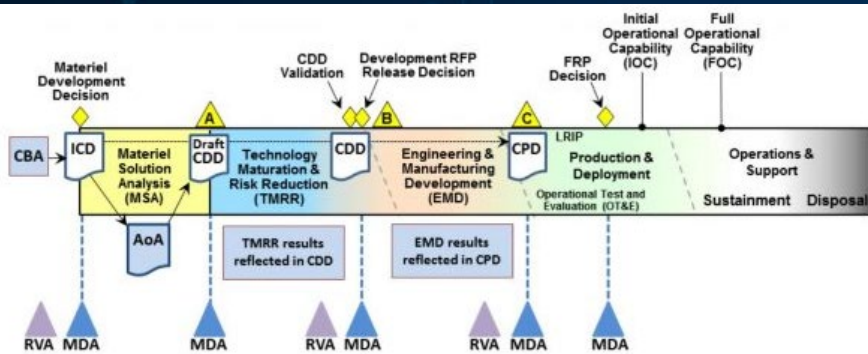


Our Current Problem...Segregated Development Streams

Current Method:

- Paper-driven reports - segregated data with impaired traceability
- Siloed developments streams - poor collaboration
- No tradespace analysis
- Lack of data consistency & storage
- No reusable baseline for modernization & Sustainment

Over time...people/SMEs change, threats & required capabilities evolve, technologies improve, budgets shrink...the process can be more dynamic with "accelerated" capability realization



CDC = Capability Development Council (Top-level – USecAF, VCSAF & USSF/CV)

SPR Pkg = the Proposal for a Solution Pathway and associated Requirements Document

Document Writing Team (Sponsor-led team of stakeholders and subject matter experts)

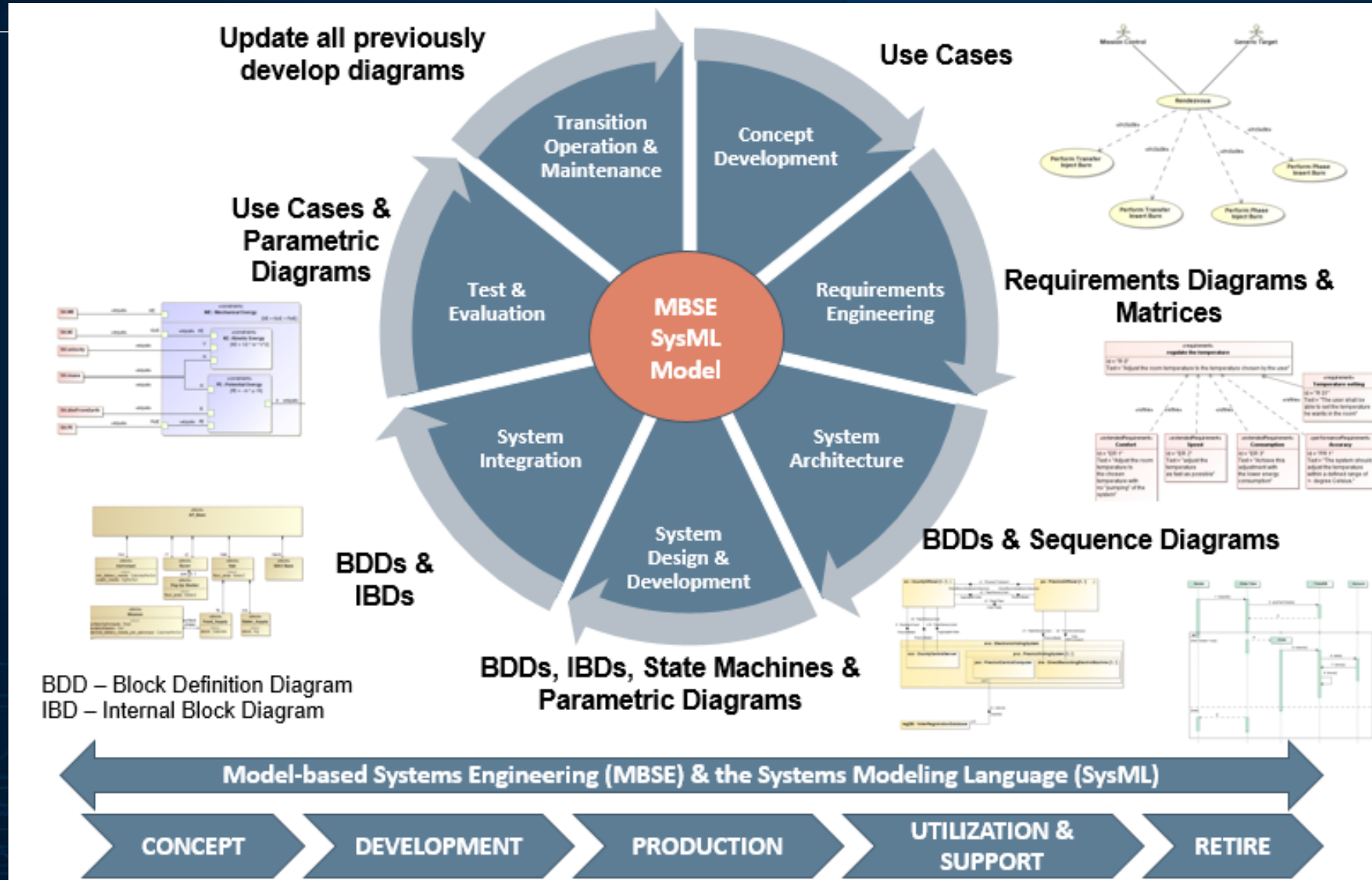
AFGK = AF Gatekeeper (decision by Director, A5RP)

RDA = AF Validation/Approval decision

RDM = Requirements Decision Memo (via eAFROC)

JCB/JROC = Joint Validation of JCIDS doc's

Where We Are Going: The Full Lifecycle Systems Engineering Process Connected



- SysML Compliant Unified Architecture Framework (UAF) :
- serves as the common data touch point integrator:
- Common taxonomy
 - Common models
 - Data integration between all SE phases
 - DoD & industry standard: SVs, OVs

Enterprise/Program/Component Traceability

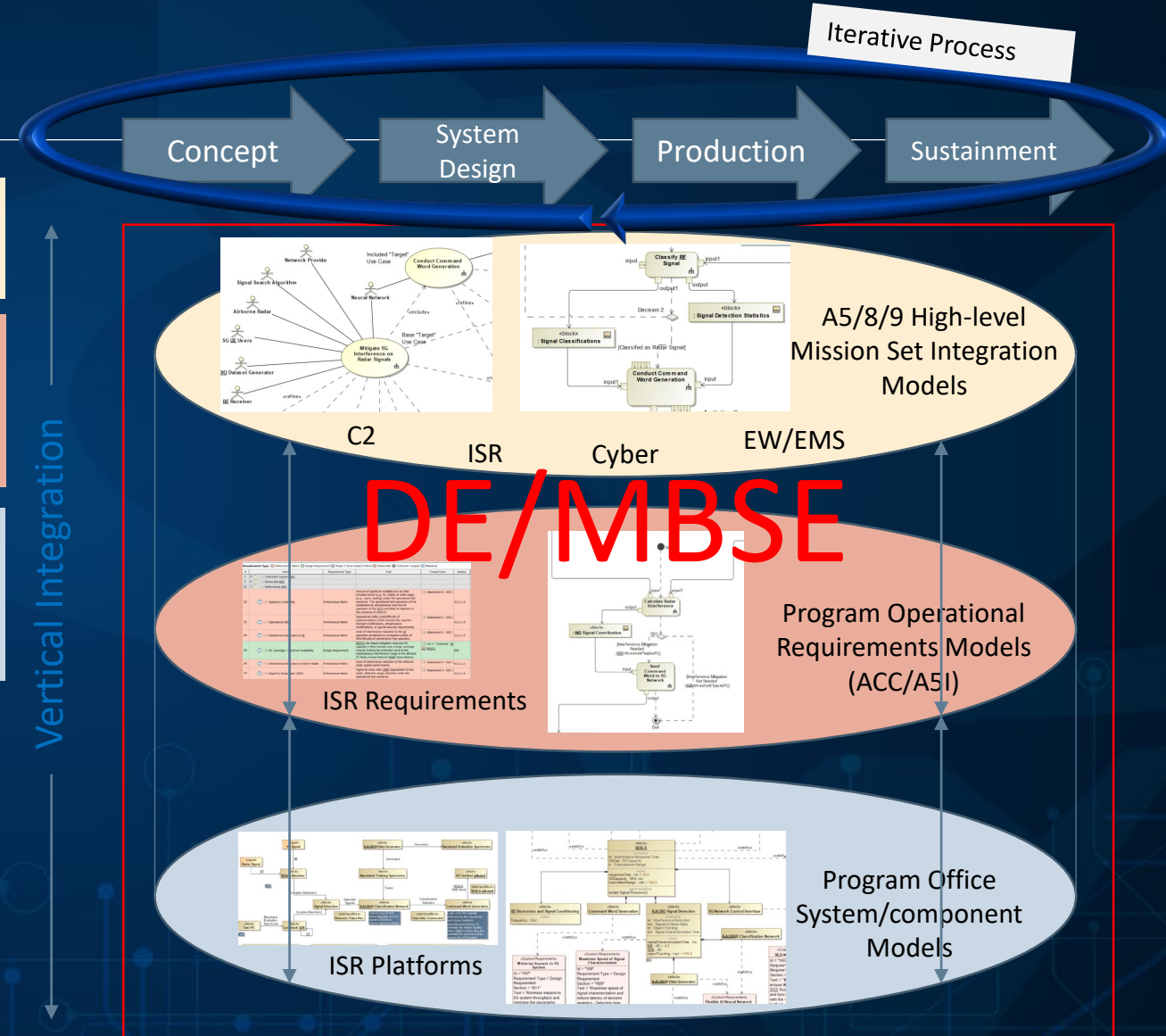
Broad in scope, includes multiple mission sets across programs (low fidelity) – **Enterprise Level**

Narrow in scope, includes specific mission sets within a program (medium fidelity) – **Program Level**

System engineering activities with traceability to high-level mission sets and requirements (high fidelity) – **System/Software Component Level**

Linked models integrating divisions and programs across warfighting mission areas and functions. The enterprise layer serves as the vision setter, tracing required capabilities and mission sets to enabling systems and technologies...providing “on demand” data-centric analysis and decision making.

Note: Linked model are highly dependent upon data and method standardization.



Enterprise → Capability → Program → System Integration

ACC Model Dependencies & Integration

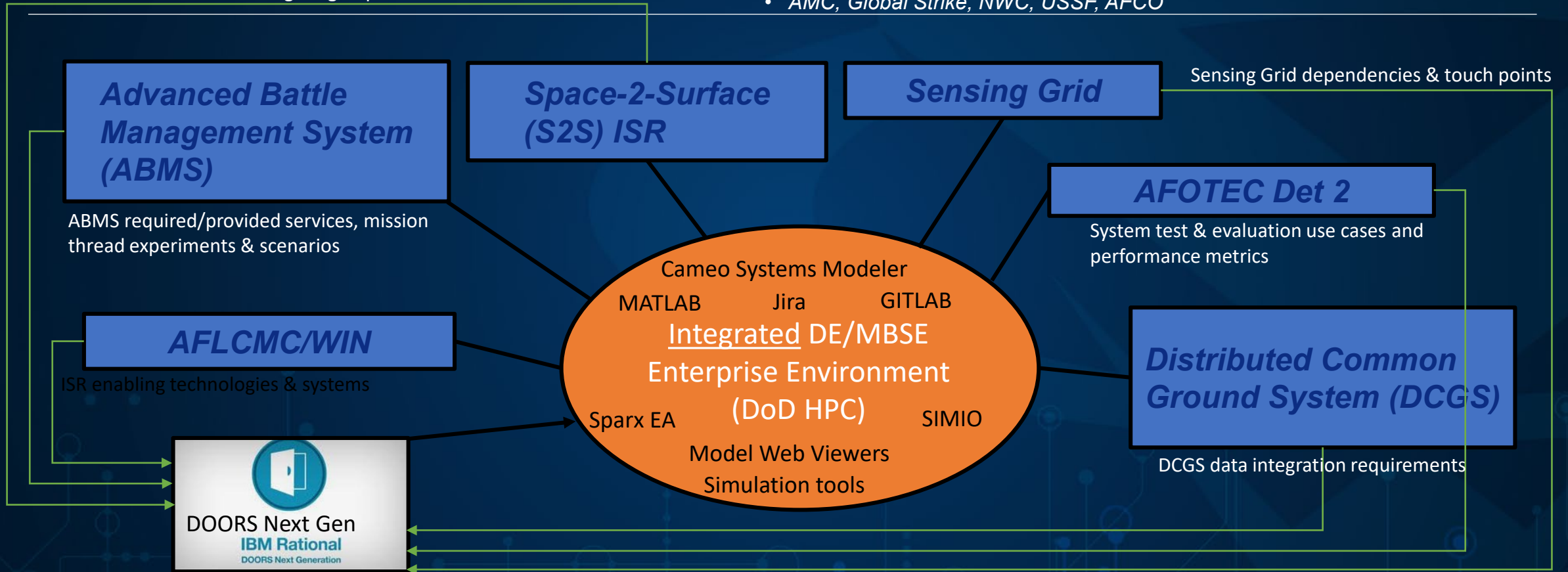
Collaborating with DAF-Wide Digital Engineering Practitioners:

- RCO/ABMS, HAF A5/7 Futures, HAF A2/6, DAF/DTO

Influencing DAF DE Practitioners:

- AMC, Global Strike, NWC, USSF, AFCE

S2S ISR warfighting requirements



DOORS NG: an authoritative & standardized data repository (common lexicon, requirements, tasks, KPPs, mission threads, use cases, etc.) enabling tool federation & mission area integration.

Required: Data Standards, Authoritative Lexicon, Federation between MBSE Tools and Integration Across Organizations & Mission Areas

MBSE Method to Tie Everything Together

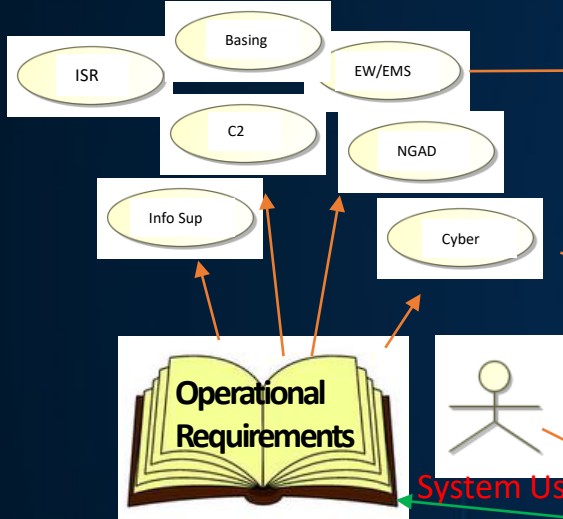
Warfighter Operational Domain

(What the systems must do)

Program Office System Domain

(How the systems do it)

NGS Operational Requirements (**Capability Identification**)



System Users

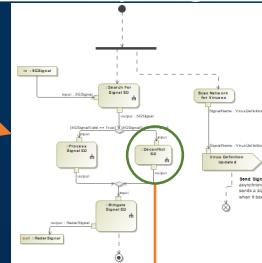
DOORS NG

Authoritative Requirements

No.	Requirement ID	Requirement Description	priority
	RODS.01	Add restaurant	
1	RODS.01.01	Login to the system	M
2	RODS.01.02	Display the admin interface	M
3	RODS.01.03	Open the restaurants list	M
4	RODS.01.04	Click the Add new link	M
5	RODS.01.05	Display the registration form	M
6	RODS.01.06	Fill up the registration form	M
7	RODS.01.07	Click the Cancel button to cancel the addition	M
8	RODS.01.8	Display the restaurants list	M
9	RODS.01.09	Click the Save button	M
10	RODS.01.10	Display an add password message if the password is not the same	D
11	RODS.01.11	Display a message if not completed fill	D

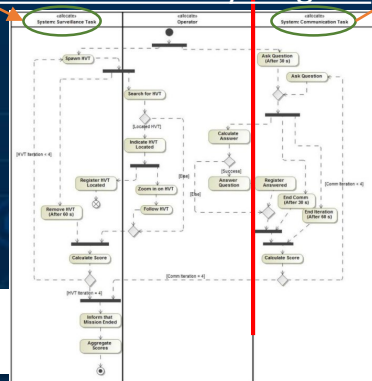
refines

Process Activity Diagram



Mission Execution Steps

Interaction Activity Diagram

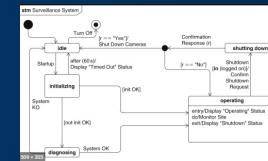


System and User Interactions
(Operational Scenarios)

NGS Family of Systems (**System Implementation**)

satisfies

State Machine Diagram



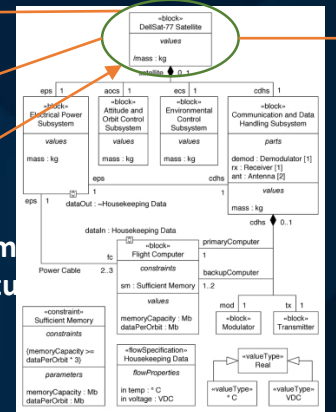
System Dynamic Behavior

System Testing Use Cases:

- Complete traceability
- Critical Operational Issues (COIs)
- Req & KPP validation testing
- MOE/MOP development
- Threat Informed Testing

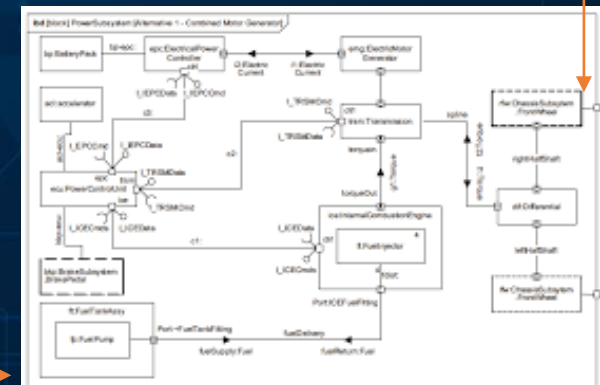
Operational and System Integration happens here

System Structure



System Structure
KPPs

System Data Flow



System Data Flows, Interfaces, Services/Software
(System Design & Implementation)

MBSE advantage: Any change to one domain has immediate impacts on the other

Mission-Centric Approach for Rapid Mission Thread Execution

Why

Mission Threads (MT):
Provides mission context using visual, standardized drawings (operational views) to understand *Why* mission capabilities are needed

What

Agile Requirements:
Defines *what* mission capabilities need to be delivered in terms of requirements prioritized against funding (capacity) and feasibility for rapid delivery

How

Scaled Agile Approach:
Governs process framework defining *how* teams work effectively across geographic and organization lines to deliver mission capability rapidly

Where

Scrum Team Products:
Aligns agile requirements to government-led scrum teams, *where* hybrid team works together to deliver capability (including products) rapidly, incrementally

C2 ISR BM

EPICs: AI/Smart, Fuse, Sensor ...
(Mapped to MT Use Case(s)) ~ A5Y

Capabilities: ART Product Mgt

Features: ART Product Mgt

User Stories: Scrum Teams

PI Objectives per 3 months

Sprints per 3 weeks

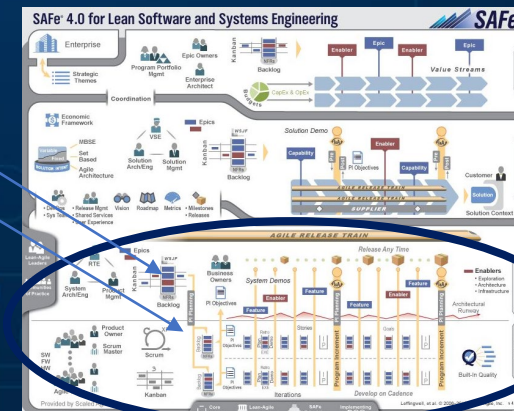
Prioritize the Mission Threads

1. Time Sensitive Targeting (Dynamic Targeting)
2. Joint Fire Support
3. Integrated Air and Missile Defense (IAMD)
4. Joint Suppression of Enemy Air Defense (JSEAD)
5. Integrated Tactical Warning and Attack Assessment
6. Cyber (Offensive Cyber Operations (OCO), Defensive Defense of Network Information (DINDO), Interagency Interoperability)
7. Joint Close Air Support (JCAS)
8. Cooperative Information Exchange (CIXE) / ITCIXE
9. Cooperative Information Exchange (CIXE) / ITCIXE
10. CIXE
11. Joint
12. CC
13. CC
14. AI
15. Int
16. M
17. CC
18. AI
19. Ta
20. Ps
21. M
22. DC
23. CC
24. Ne
25. Ne
26. GI
27. Sx
28. UNCLASSIFIED
29. Defense Support to C
30. Civil Information Man
31. Counter Drug
32. Combating Transnat

Joint Mission Threads

Version 2
12 November 2015

Backlog



Backlog

Summary

- Air Force moving from “paper driven” needs and requirements
- Moving to model based capability and digital data/architecture descriptions
- Mission thread analysis allows for use cases to be worked out and drive acquisition requirements
- Mission focus to be addressed through acquisition, test and operation/sustainment
- Main objective: get capabilities to the warfighter *faster*