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The Developmental Evaluation Framework's (DEF) Evolution Through Acquisition Cycle

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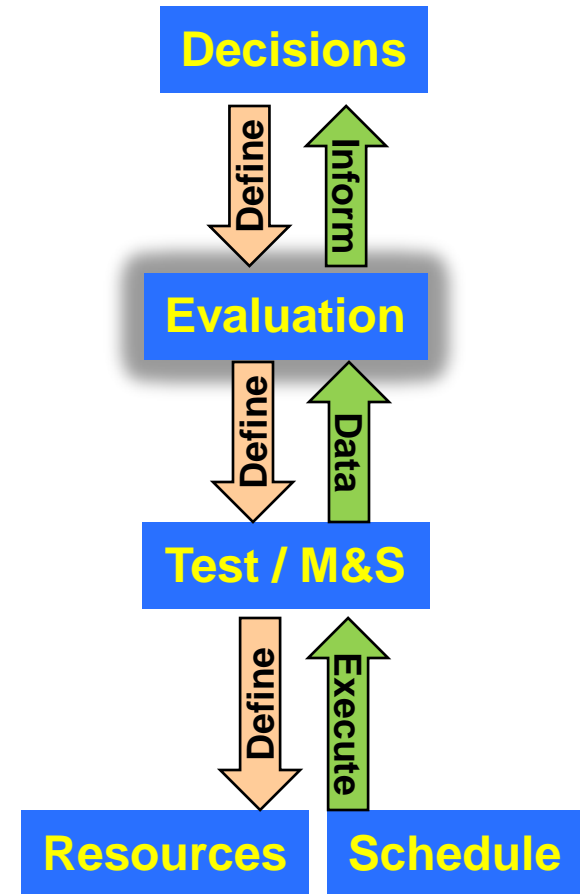
NDIA T&E Conference

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Briefing Purpose & Overview



- **Developmental Evaluation Framework (DEF) part of TEMP's SE-V story:**
 - How acquisition, technical and programmatic *decisions* will be informed by evaluation
 - How system will be *evaluated*
 - How *test and M&S events* will provide data for evaluation
 - What *resources* are required to execute test, conduct evaluation, and inform decisions
- ***Time-phased & evolving*** - developed early (pre-Milestone-A) and evolved to meet program's information needs
 - As decision-maker questions change
 - As program requirements mature

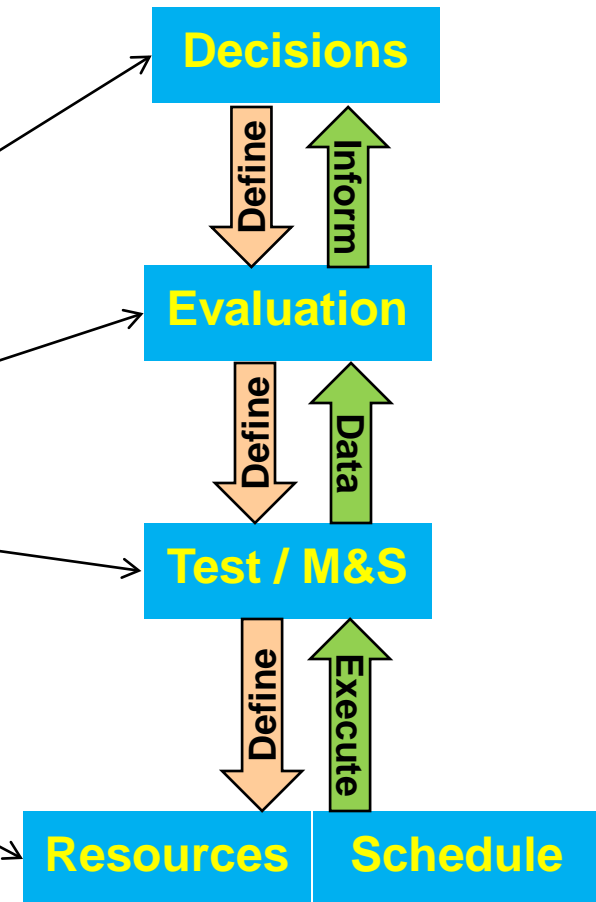


DT&E Strategy Overview



Articulate a logical *evaluation* strategy that informs decisions

- How acquisition, programmatic, technical and operational decisions will be *informed* by evaluation
- How system will be *evaluated*
- How test and M&S events will provide *data* for evaluation
- What *resources* are required to execute test, conduct evaluation, and inform decisions



DT&E story thread: decision – evaluation – test & resources

Developmental Evaluation Framework

(Enclosure 4, DoD Interim Instruction 5000.02)



Test and Evaluation Master Plan (TEMP) includes a Developmental Evaluation Framework (“T&E Roadmap”)

- Knowledge gained from testing provides information for technical, programmatic, and acquisition decisions.

DoDI 5000.02 (Interim)

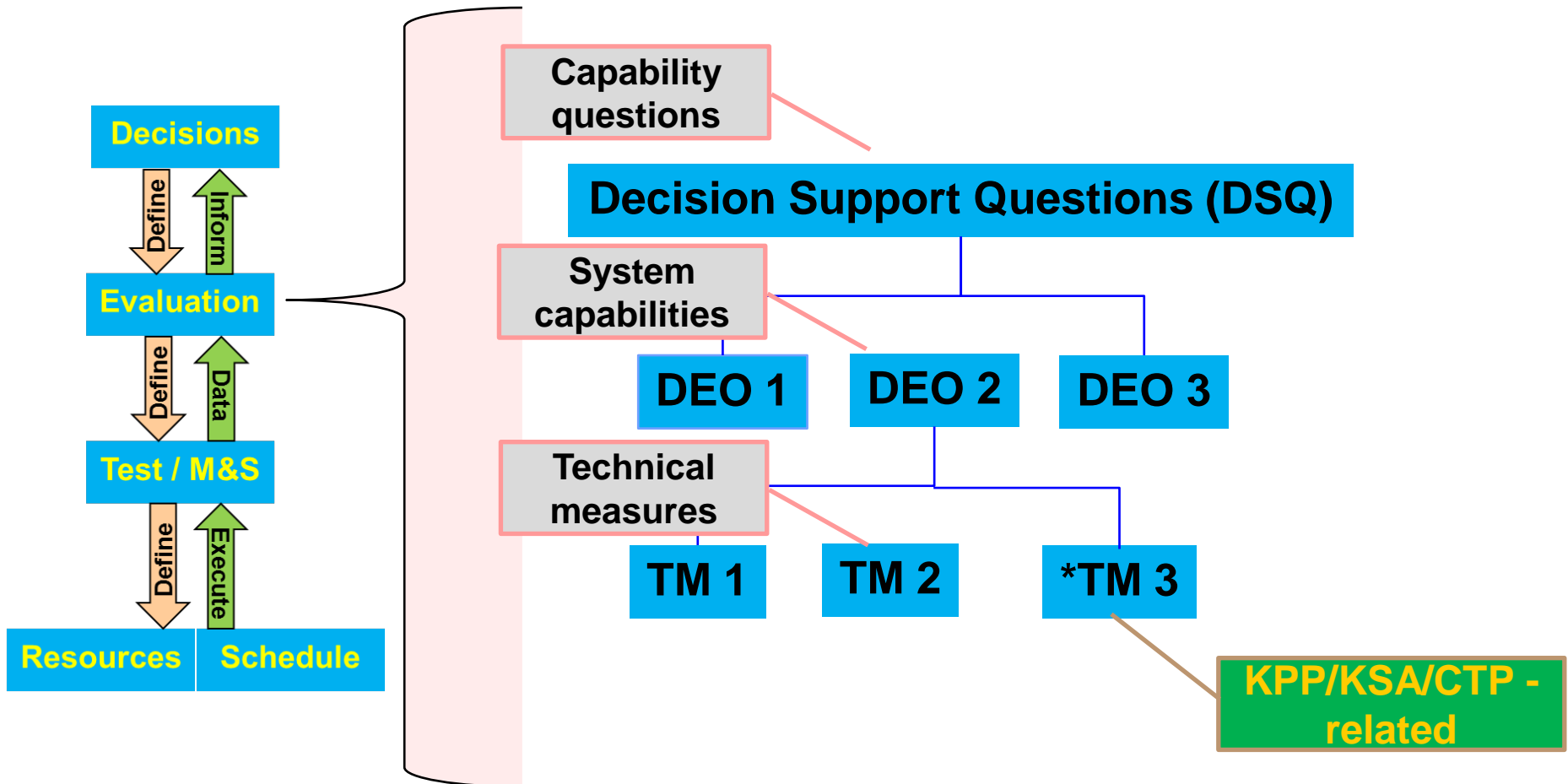
Developmental Evaluation Framework:

- Identifies key data that contributes to assessing progress on:
 - Key Performance Parameters
 - Critical Technical Parameters
 - Key System Attributes
 - Interoperability requirements
 - Cybersecurity requirements
 - Reliability growth
 - Maintainability attributes
 - Developmental test objectives
 - Others as needed
- Show the correlation/mapping between:
 - Test events
 - Key resources
 - Decision supported

Developmental Evaluation Objectives		Decisions Supported									
System Requirements and T&E Measures											
Functional evaluation areas	Technical Reqrmts	Identify major decision points for which testing and evaluation phases, activity and events will provide decision supporting information. Cells contain description of data source to be used for evaluation information, for example: 1) Test event or phase (e.g. COT1...) 2) M&S event or scenario 3) Description of data needed to support decision 4) Other logical data source description									
System capability categories	Document Reference	Description									
Performance											
Interoperability											
Cybersecurity											
Reliability											

**Developmental Evaluation Framework
(Defense Acquisition Guidebook)**

Developmental Evaluation Framework (DEF)



**System Engineering decomposition:
Evaluate system capability - Inform decisions**

The TEMP's DT&E Strategy Story

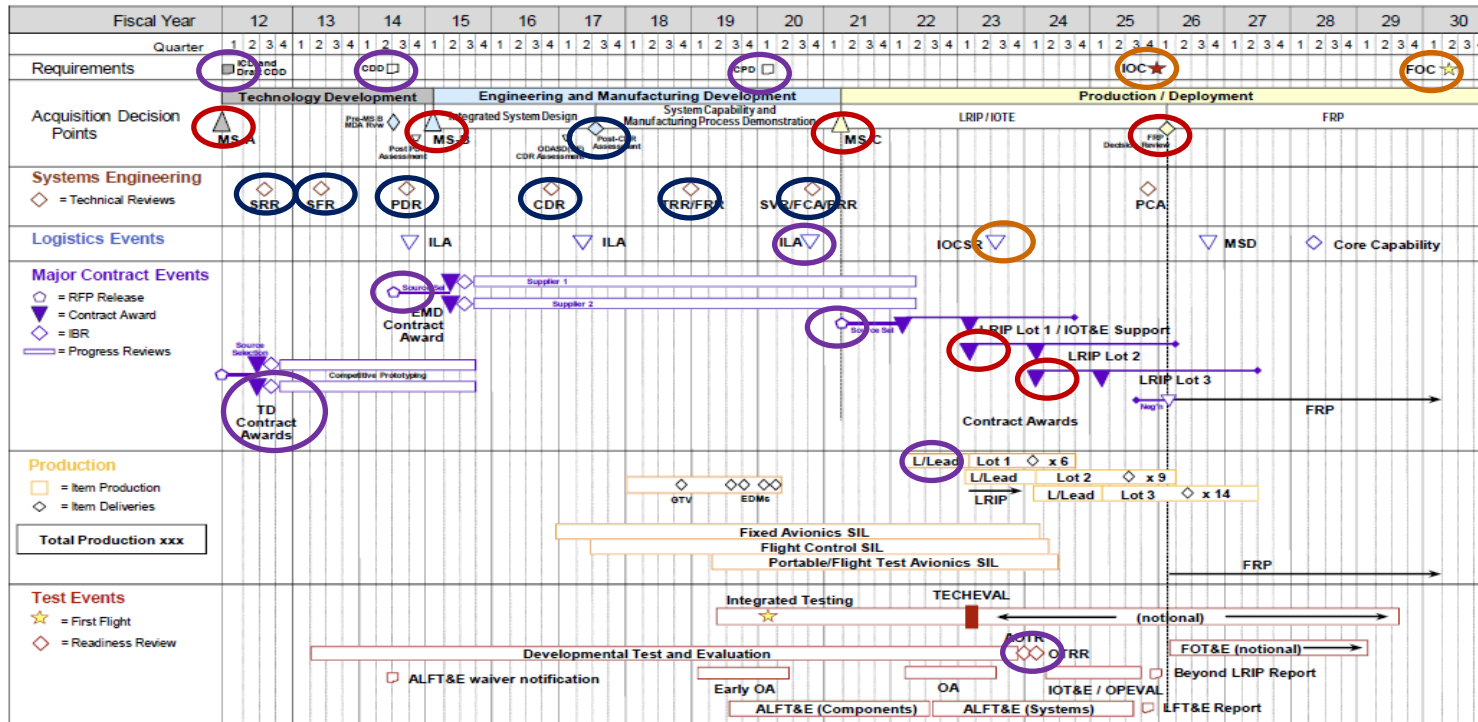


- TEMP tells the decision – evaluation – test/M&S story
 - Section 3.1 – T&E Strategy. Describe how T&E informs Acquisition Strategy decisions
 - Figure to accompany verbiage: Decision Support Key (DSK)
 - Describes decisions and T&E information needed
 - Section 3.3 – Developmental Evaluation Approach. Describe how system will be evaluated to inform decisions
 - Figure to accompany verbiage: Developmental Evaluation Framework (DEF)
 - Links decisions – evaluation – test/M&S events
 - Section 3.6 – Operational Evaluation Approach.
- Decision Support Key (DSK) & Developmental Evaluation Framework (DEF) built by Chief Dev Tester
 - DEF Core Team is subgroup of T&E WIPT including Chief Developmental Tester and select SME's

DT&E Informed Decisions



Figure 3. Notional depiction of the Integrated Schedule for Program



- Acquisition
- Programmatic
- Technical
- Operational

AOTR: Assessment of Operational Test Readiness
 ALFT&E: Alternative Live Fire Test & Evaluation
 CDR: Critical Design Review
 EDM: Engineering Development Model
 EMD: Engineering & Manufacturing Development
 FCA: Functional Configuration Audit
 FOT&E: Follow-On Operational Test & Evaluation
 FRP: Full Rate Production
 FRR: Flight Readiness Review
 GTV: Ground Test Vehicle
 ILA: Integrated Logistics Analysis

IOCSR: Initial Operational Capability Supportability Review
 IOT&E: Initial Operation Test & Evaluation
 LFT&E: Live Fire Test & Evaluation
 LRIP: Low-Rate Initial Production
 MDA: Milestone Decision Authority
 MSD: Material Support Date
 OA: Operational Assessment
 OASD(SE): Office of the Assistant Secretary of Defense (Systems Engineering)
 OPEVAL: Operational Evaluation

OTRR: Operational Test Readiness Review
 PCA: Physical Configuration Audit
 PDR: Preliminary Design Review
 PRR: Production Readiness Review
 SFR: System Functional Review
 SIL: Systems Integration Lab
 SRR: System Requirements Review
 SVR: System Verification Review
 TD: Technology Development
 TECHEVAL: Technical Evaluation
 TRR: Test Readiness Review

**Informing decisions throughout lifecycle:
 Same DEF concept/form; *Different* decisions and system info**

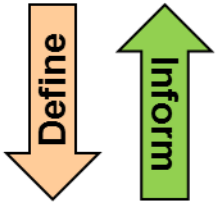
Decision Support Key



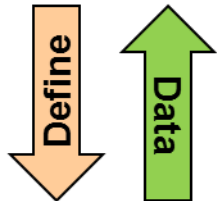
Show how decisions will be informed by answering T&E focus questions: DT&E Decision Support Questions (DSQs) and OT&E Critical Operational Issues (COIs)

- TEMP Section 3.1 – T&E Strategy – Describes how program’s Acquisition Strategy is informed by T&E Strategy

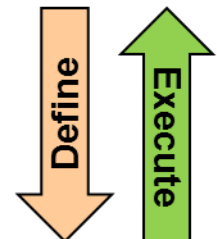
Decisions



Evaluation



Test / M&S

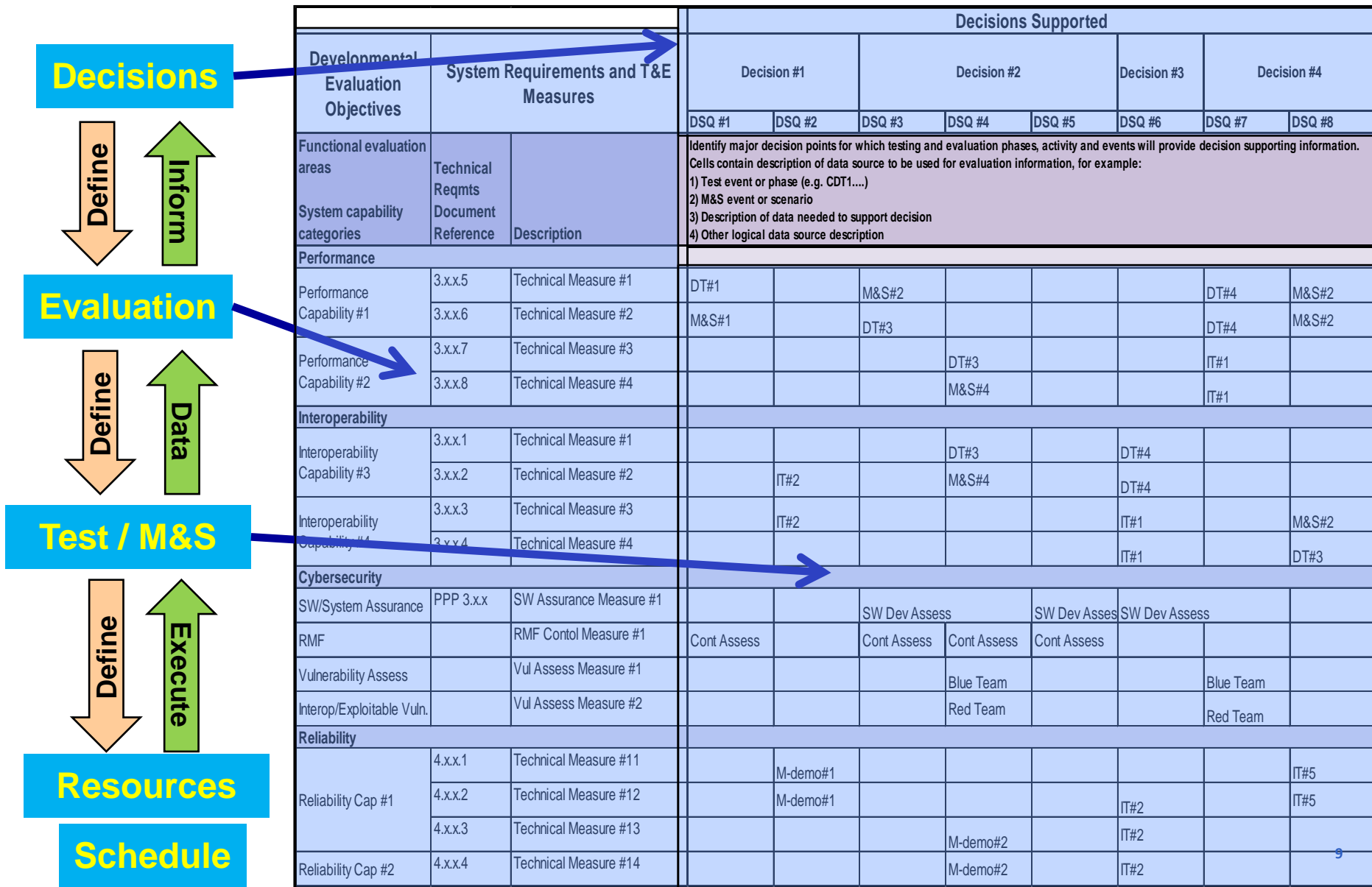


Resources

Schedule

Decision	Decision Description	T&E Info Source
Decision#1 (Component maturity)	Major component technical maturity	DSQ#1, DSQ#4, DSQ#5
Decision#2 (Platform maturity)	Adequacy of host platform to accept major component integration	DSQ#2
Decision#3 (Component integration readiness)	Major component integration readiness	DSQ#1, DSQ#2, DSQ#5
Decision#4 (Initial sea trials)	Integrated system performance in ops environment	DSQ#1-5; CO#1
Decision#5 (IOC)	Initial operational capability	CO#1-4
Decision#6 (Sustainment mod)	Adequacy of sustainment modification	DSQ#4, DSQ#5, CO#1-4
Decision#7 (FOC)	Full operational capability	CO#1-4

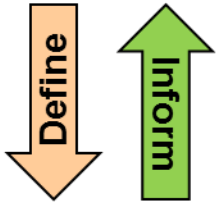
Developmental Evaluation Framework



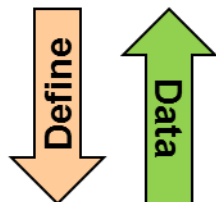
Link Resources & Schedule



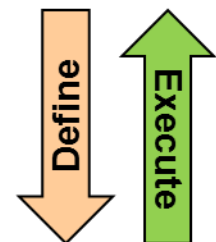
Decisions



Evaluation



Test / M&S



Resources

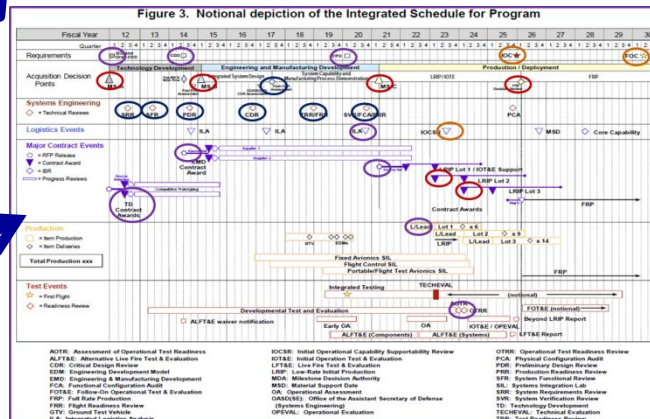
Schedule

Fiscal Year		14	15	16	17	18	19	18-20	16-20
TEST EVENT		DT1	DT2	DT3	IST1	IST2	IST3	Demo1-2	Exercise 1-5
RESOURCE	Units								
Resource#1: TVAC	Hours	50	80				40		
Resource#2: Acoustic Chamber	Hours		50	80			40		
Resource#3: RF Chamber	Hours		40	80			40		
Resource#4: SIL	Hours	25	25	25	80	80	80	40	200
M&S Model#1	Runs		50	132	60	100	140	30	30
M&S Model#2	Runs		50	132	60	100	140	30	30
Resource#5: Arnold AFS 6' Chamber	Hours			40			40		120

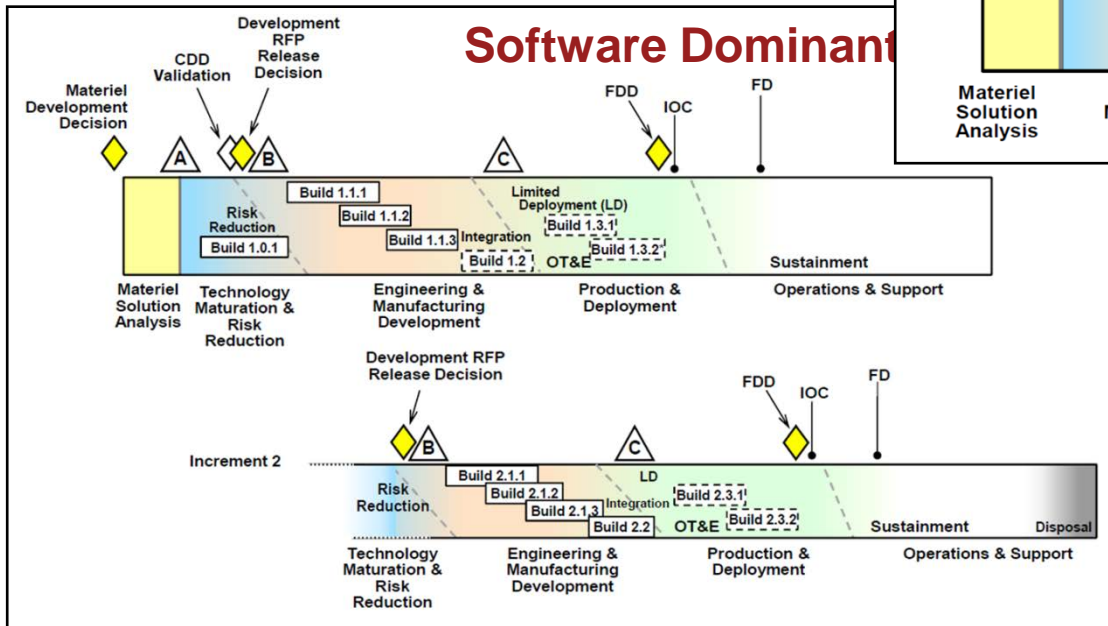
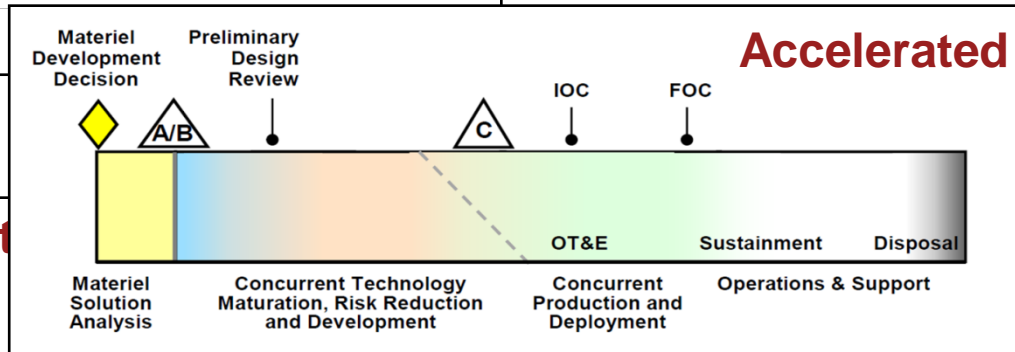
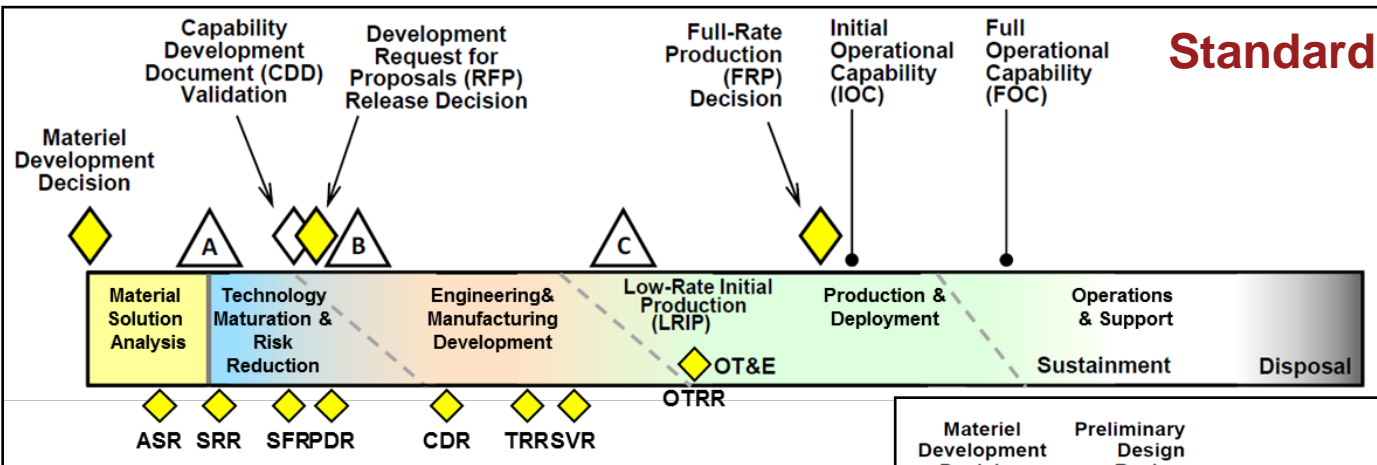
Link **key resources** and **schedule** to DEF

- Describe logical linkage of test/M&S events to necessary resources in Section IV
- Describe linkage of decisions, evaluation, test, and M&S events to schedule in programmatic schedule in Section II

Figure 3. Notional depiction of the Integrated Schedule for Program

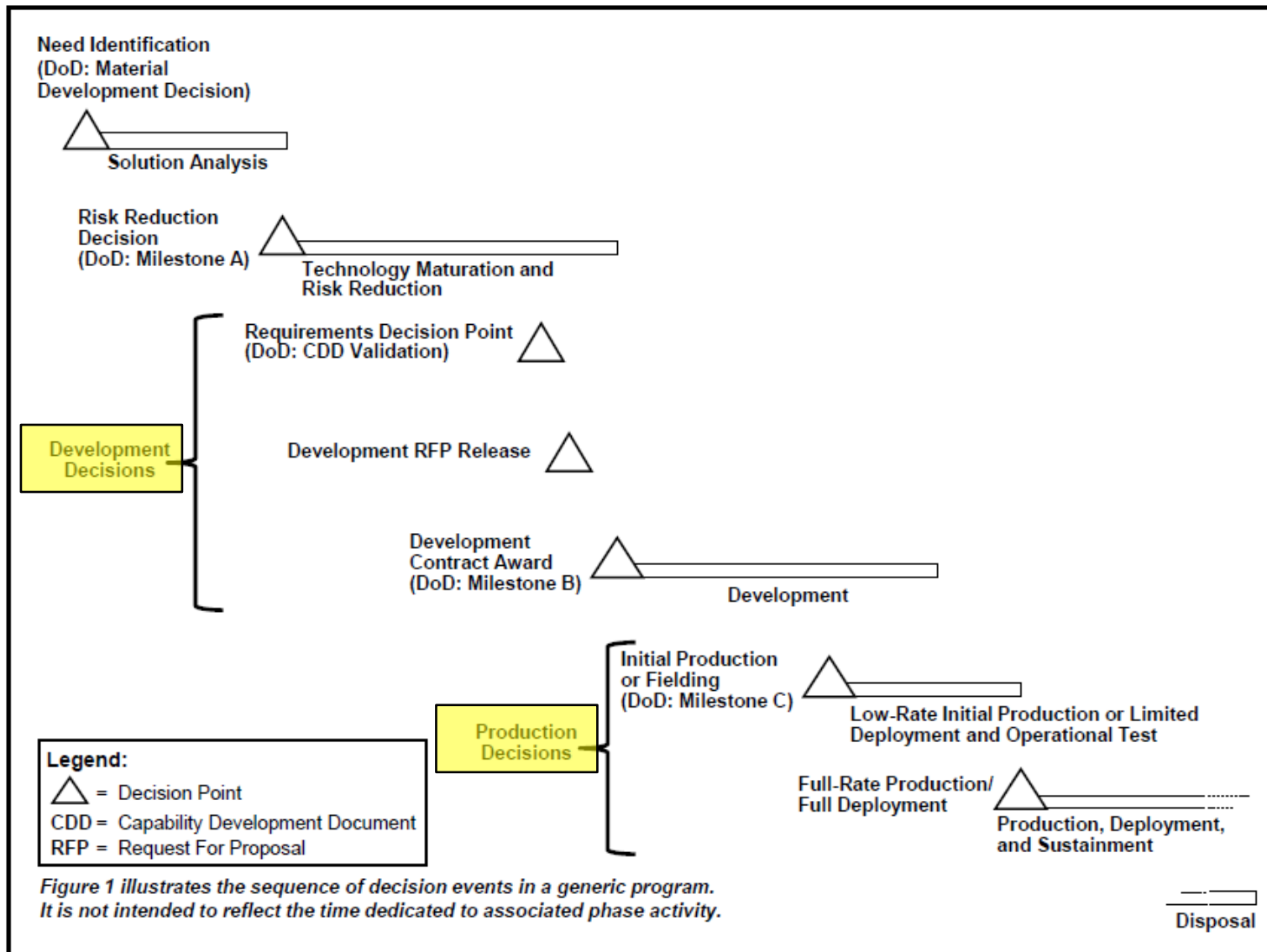


Varied DoD Acquisition Cycles



Same DEF concept/form
Different decisions and system info

Generic Acquisition Cycle & Decision Points



MS-A Decision & DEF Focus



- Milestone A: Technology Development
 - Decision focus: Approves entry into Tech Maturation and Risk Reduction (TMRR) phase
 - MS-A to MS-B activities/decisions
 - TMRR phase – mature technology, reduce program risk
 - Developmental RFP release
 - Preliminary Design Review
 - MS-A TEMP DEF focus, informing:
 - TMRR phase decisions, including:
 - Design and requirements trades
 - Mature Capability Requirements
 - Technology viable/mature enough for the design of the system
 - Development RFP Release Decision Point
 - Requirements are firm and clear (CDD Validation)
 - Development/production risk reduced
 - Preliminary Design Review (PDR)
 - Competitive prototype performance

MS-A TEMP DEF



			Decisions Supported						
Developmental Evaluation Objectives	System Requirements and T&E Measures		MS-A			RFP Release		PDR	
			Which materiel solution alternative best meets needs?	What is the scope and priority of the capability requirements trade space	Status of/need for technical risk reduction.	Is technology viable/mature enough for the design of the system?	How are the prototypes performing against capability requirements?	How are the prototypes performing against capability requirements?	How will the designs perform against capability requirements?
Functional evaluation areas	Technical Reqmts Document Reference	Description							
System capability categories									
Performance									
ICD Category #1		ICD Performance Reqmt #1	AoA perf assessment		Tech risk reduce	Tech risk reduce	Early DT&E perf assessment	Early DT&E perf assessment	Early DT&E perf assessment
ICD Category #2		ICD Performance Reqmt #2		Reqmt improvement				Early DT&E perf assessment	Early DT&E perf assessment
Interoperability									
ICD Category #3		ICD Interoperability Reqmt #1	AoA perf assessment	Reqmt improvement			Early DT&E perf assessment	Early DT&E perf assessment	Early DT&E perf assessment
ICD Category #4		ICD Interoperability Reqmt #2			Tech risk reduce	Tech risk reduce		Early DT&E perf assessment	Early DT&E perf assessment
Cybersecurity									
ICD Category #5		ICD Cybersecurity Reqmt #1	AoA perf assessment				Early DT&E perf assessment	Early DT&E perf assessment	Early DT&E perf assessment
ICD Category #6		ICD Cybersecurity Reqmt #2		Reqmt improvement	Tech risk reduce	Tech risk reduce		Early DT&E perf assessment	Early DT&E perf assessment
Reliability									
ICD Category #7		ICD Reliability Reqmt #1	AoA perf assessment				Early DT&E perf assessment	Early DT&E perf assessment	Early DT&E perf assessment
ICD Category #8		ICD Reliability Reqmt #2		Reqmt improvement	Tech risk reduce	Tech risk reduce		Early DT&E perf assessment	Early DT&E perf assessment

MS-B Decision & DEF Focus



- Milestone B: Enter EMD Phase
 - Decision focus: Approves entry into Engineering Manufacturing Development (EMD) phase
 - MS-B to MS-C activities/decisions
 - Develop, build, test product to verify requirements are met
 - Production or deployment decisions
 - MS-B TEMP DEF focus, informing:
 - Capability requirements compliance, combat capability delivered

MS-B TEMP DEF



			Decisions Supported						
Developmental Evaluation Objectives	System Requirements and T&E Measures		CDR		Acquisition Decision #1		Acquisition Decision #2		
			What final design adjustments should be made for combat effectiveness?	How will the design perform against capability requirements?	Are the components meeting requirements?	Is integrated system meeting performance requirements?	Is reliability performance in line with RGC?	Is system able to perform mission?	Is system secure?
Functional evaluation areas	Technical Reqmts	Description							
System capability categories	Document Reference								
Performance									
CDD Category #1	3.x.x.1	CDD Performance Reqmt #1	Early DT&E perf assessment	Early DT&E perf assessment	Component DT&E			DT&E 1	Early DT&E perf assessment
CDD Category #2	3.x.x.2	CDD Performance Reqmt #2	Early DT&E perf assessment	Early DT&E perf assessment	Component DT&E				
Interoperability									
CDD Category #3	3.x.x.3	CDD Interoperability Reqmt #1	Early DT&E perf assessment	Early DT&E perf assessment		IST #1			Early DT&E perf assessment
CDD Category #4	3.x.x.4	CDD Interoperability Reqmt #2	Early DT&E perf assessment	Early DT&E perf assessment		IST #1		DT&E 1	
Cybersecurity									
CDD Category #5	PPP 3.x	CDD Cybersecurity Reqmt #1	Early DT&E perf assessment	Early DT&E perf assessment		Cyber Vuln Assessment			Blue Team Assessment
CDD Category #6	PPP 3.x	CDD Cybersecurity Reqmt #2	Early DT&E perf assessment	Early DT&E perf assessment		Cyber Vuln Assessment		DT&E 1	Blue Team Assessment
Reliability									
CDD Category #7	4.x.x.1	CDD Reliability Reqmt #1	Early DT&E perf assessment	Early DT&E perf assessment			Mnx Demo #1		Early DT&E perf assessment
CDD Category #8	4.x.x.2	CDD Reliability Reqmt #2	Early DT&E perf assessment	Early DT&E perf assessment			Mnx Demo #1	DT&E 1	

Examples



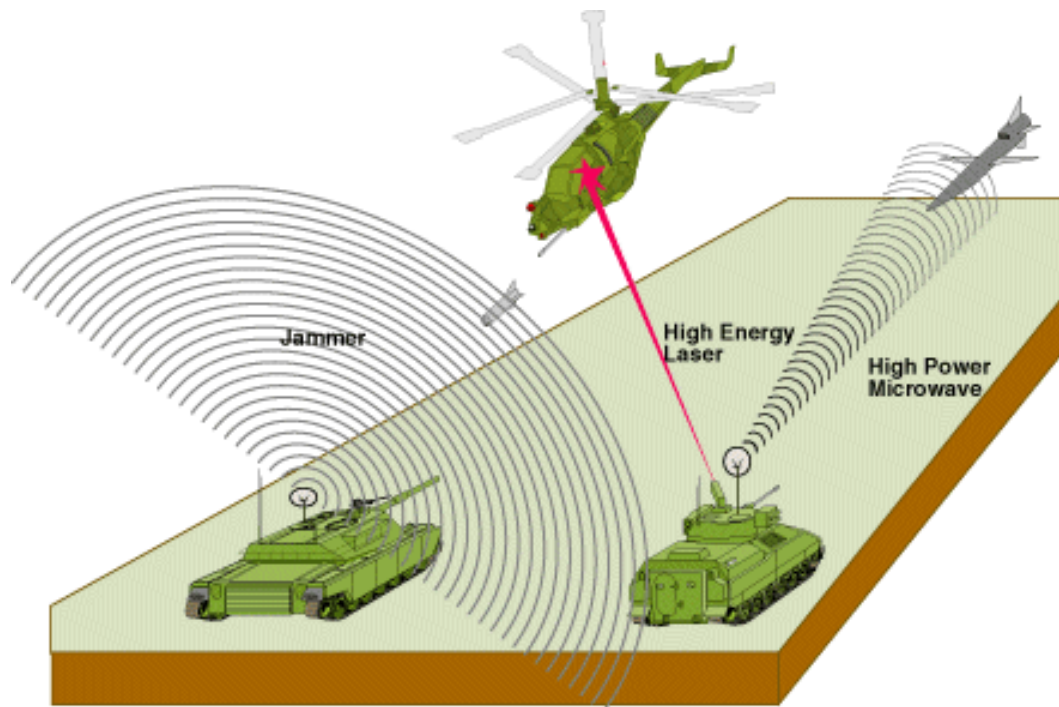
■ Example programs

- **Milestone A: DASD(RF) Example (to be)**
 - **DEF focus: Assess technology & document technology demonstration for future use**
- **Milestone B:**
 - **Space Fence DEF focus: Capability evaluation to inform prototype downselect**
 - **CIRCM DEF focus: Ensure technology readiness for contract award**
- **Milestone C: GPS Enterprise**
 - **DEF focus: Production decision for user equipment**

MS-A Example: DASD(RF) Program



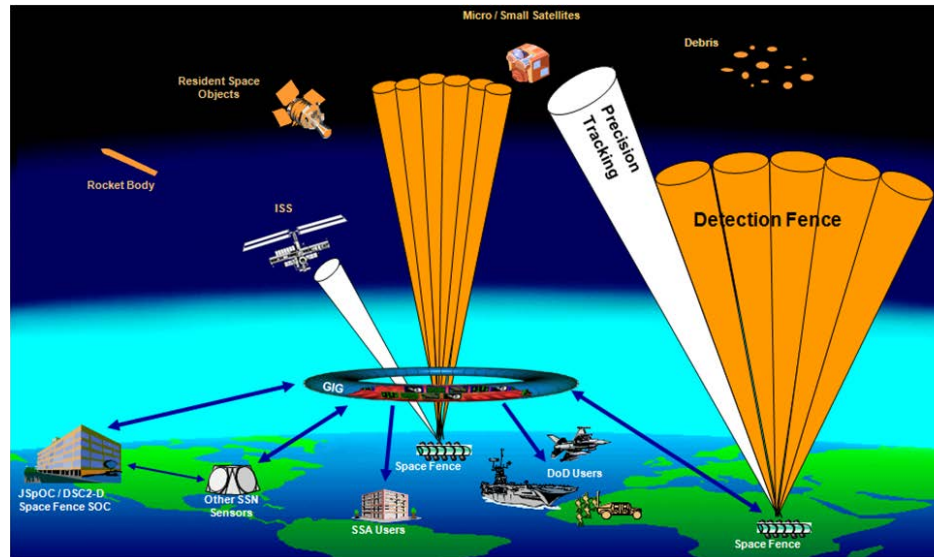
- **Assess/document technology for ops application**
 - Total ownership cost (reliability, manufacturability)
 - Resiliency (evolving threat)
 - “Good enough” capability
 - False alarm rate: Leave in box vs. use



MS-B Example: Inform Downselect



Technical Mission Statement: Design and build a ground based radar system to provide LEO and MEO coverage to meet space situational awareness mission requirements



Does the **radar** provide coverage, sensitivity, and accuracy sufficient to detect and track LEO and MEO objects?

Is the radar **data processing**, handling, and storage sufficient to characterize, correlate, track, and report space objects?

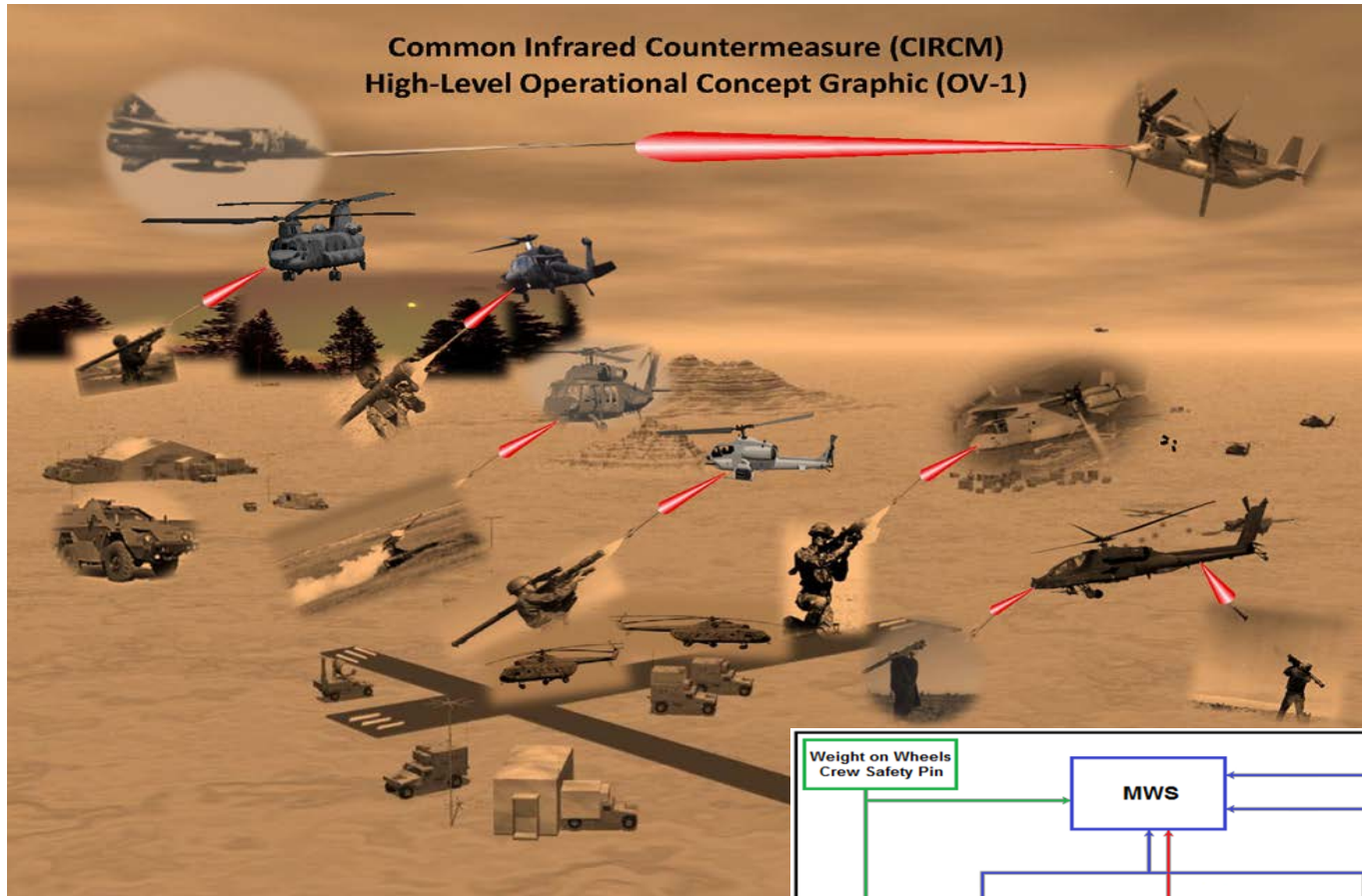
Are **command and control** and interfaces sufficient to provide tasking to the radar and surveillance information to the SSA customer

Are **environmental effects** sufficiently planned for and executed?

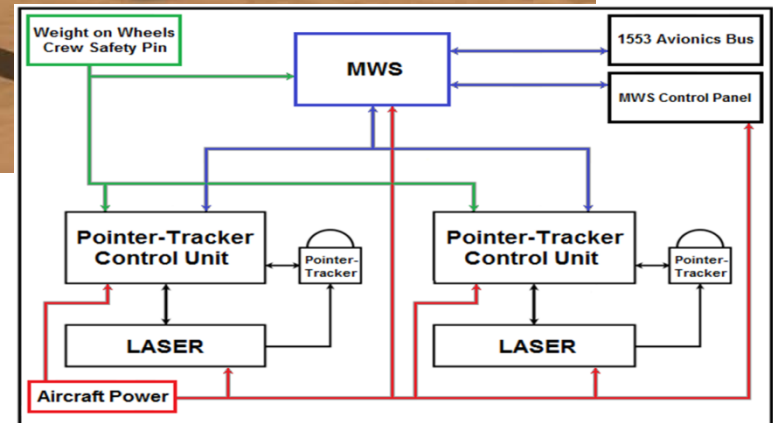
Are planned and executed system and **information protections** sufficient to ensure information assurance and physical security?

Are **Life Cycle Cost** factors considered and balanced with other design factors sufficient to provide a reliability, maintainable, available, and economical system?

MS-B Example – CIRCM Technology Assess



**Laser-based jam head
integrated on Joint platforms
to defeat IR seeking threat missiles**



CIRCM Decision Support Key



<u>Decision</u>	<u>Rationale</u>	<u>Developmental Information Needed</u>
Pre-EMD Review	RFP release for EMD.	Tech Maturity (DSQ-2); Weight (DSQ-2); Msn capability (DSQ-3)
Milestone B	Technology matured and acceptable integration risks.	Weight (DSQ-2); Mission capability (DSQ-3); Supportability (DSQ-5)
First flight	Able to begin flight testing of capability	Platform Integration (DSQ-4); Supportability (DSQ-5)
LRIP-1 Long Lead	Design is stable, integration demonstrated. Significant (Cat I) deficiencies remain.	Supportability (DSQ-5)
Milestone C	Ready to commit to production. Capable in development flight environment, fully acceptable reliability.	Platform Integration
LRIP-2	Ready to commit to second increment. Significant design issues have been identified. Fixes to significant deficiencies deferred. Have been validated in flight test.)	Reliability (COI-2);
AW Certification	Ability of the platform aircraft to safely attain, sustain, and terminate flight with and operating within limitations.	Reliability (COI-2);
First deployment	Ready to perform limited operational	4); Platform
OTRR	Ability to complete the dedicated operations (IOT&E) with no significant issues affecting operational effectiveness, operational suitability, or survivability.	4); Supportability (DSQ-5)
FRP	Production processes are mature, no significant design deficiencies remain.	Mission capability (DSQ-3); Platform Integration (DSQ-4); Supportability (DSQ-5). Operational capability (COI-1); Platform mission capability (COI-2); Suitability (COI-3)
IOC	Sufficient capability and support in place to begin normal operational ops.	Supportability (DSQ-5). Operational capability (COI-1); Platform mission capability (COI-2); Suitability (COI-3)

DSQs

Are the CIRCM design and components **technically mature**?

Does the CIRCM **weight** allow integration into host platforms without adverse payload effects?

Does CIRCM **counter threat missiles**?

Do CIRCM components **integrate** with aircraft and MWS?

Are **robustness, HSI and sustainment** adequately addressed to enable operations?

Does CIRCM's HSI provides situational awareness sufficient to **support tactics employment** and does not significantly affect operator or maintainer workload

CIRCM DEF



Developmental Evaluation Framework Matrix				Decisions Supported										
Functional Evaluation Area	Key System Requirements and T&E Measures			Pre-EMD Review	Milestone B	First Flight	LRIP-1 Long Lead	Milestone C (LRIP-1)	LRIP-2	AW Certification	First deployment	OTRR	FRP	IOC
(major functional areas, from Funct./Alloc. Baseline products when available)	Technical Requirements Document Reference	Description	Technical Measures (e.i., CTP, TPM, req'd)	Identify major decision points for which testing and evaluation phases, activity and events will provide decision supporting information. Decision points and supporting information may be acquisition, programmatic, technical or operationally related. Display descriptive information in the below cells in an abbreviated manner similar to the following format: 1) Test event or phase (e.g. CDT1...) 2) Test method, technique, parameters ... 3) Description of data needed to support decision 4) Other										
Performance	3.X.X.3 3.X.X.8 3.X.X.9 3.X.X.11 3.X.X.17	Coverage Energy on Dome Protection Probability Eff Counter Spectral Bands	Radius: 100 miles 9-1 >10 >8 9-1	CDT1, CDT2.				CDT1, CDT2.		CDT1, CDT2, DT1, DT2, DT3, OA				
Capabilities				Technical Measures										
Counteracting threats Computer processing Software Environmental ops conditions Safety A/C platform interface MWS interface CIRCM physical characteristics Transportability Interchangability Human-System interface Reliability Logistics Security				From ASE-9001 CIRCM System Spec										
				T1, DT2, T3, A	DT1, DT2, DT3, OA		DT1, DT2, DT3, OA	DT1, DT2, DT3, OA			CDT1, CDT2, DT1, DT2, DT3, OA			
				DT2, T2, DT3				CDT2, DT2, DT3	CDT2, DT2, DT3					
				DT2, T2, DT3		CDT2, DT2, DT3	CDT2, DT2, DT3	CDT2.	CDT2.		CDT2.	CDT2.	3	CDT2, DT2, DT3
				T3, Physical Configurati Audit (PCA)				DT3, Physical Configurati Audit (PCA)		DT3, Physical Configurati Audit (PCA)				
					DT3, Physical Configurati Audit (PCA)	DT3, Physical Configurati on Audit (PCA)	DT3, Physical Configurati on Audit (PCA)	DT3, Physical Configurati Audit (PCA)		DT3, Physical Configurati Audit (PCA)	DT3, Physical Configurati Audit (PCA)	DT3, Physical Configurati on Audit (PCA)	DT3, Physical Configurati on Audit (PCA)	DT3, Physical Configurati on Audit (PCA)
	3.X.X.X 3.X.X.X 3.X.X.X 3.X.X.X	Operating Life Ops availability Material availability Failures	10 years >95% >95% 6year											

Test & M&S Events
Data sources for evaluation to inform decisions

MS-C Example – GPS Enterprise



Global Positioning System (GPS) Enterprise modernization : satellite (GPS III), control segment (OCX), user equipment (MGUE)

Inform Operational Readiness & Program Acquisition Decisions



Can GPS provide accurate PNT data to users?

Does GPS support NAVWAR operations?

Can GPS support secondary payload missions?

Can the control segment command and control the constellation?

Is GPS secure?

Is GPS sustainable?

Enterprise EF DSQ – Guide cross-segment evaluation for operational readiness decisions



Segment EF DSQ – Guide evaluation for segment acquisition decisions

Can MGUE support both legacy and modernized signals?

Can MGUE be integrated into lead platforms to support msn ops?

Is MGUE secure?

Can MGUE operate in a NAVWAR environment?

Is MGUE sustainable?

Summary & Way Ahead



- **DEF focuses system evaluation (in mission context) to inform decisions**
 - DSQ (decision) → DEO (capability) → TM (measure)
- **DEF evolves as program decisions change and information matures**
- **Way Ahead**
 - DASD(DT&E) is ready, willing, able, and anxious to help your program succeed!
 - Contact us for DEF Core Team

