15th System-of-Systems Engineering Workshop

Reducing Risk in 2020

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Inside the Beltway

- **SecDef Confirmation**

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- **BBP 3.0 underway**

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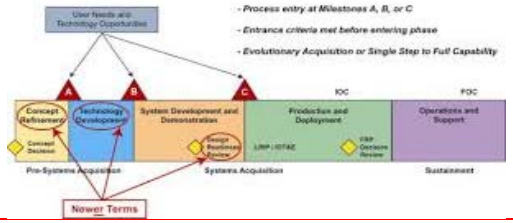
- **New DoDI 5000.02**



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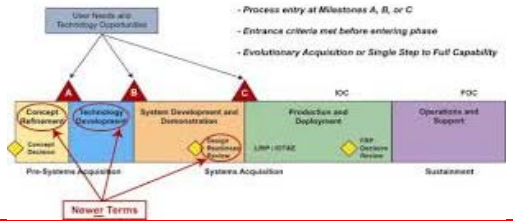

- **DoD Budget submission**

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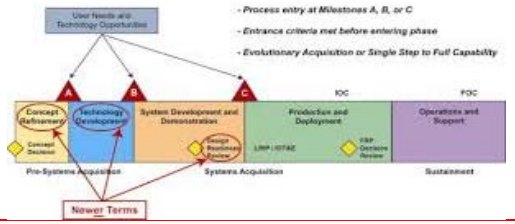
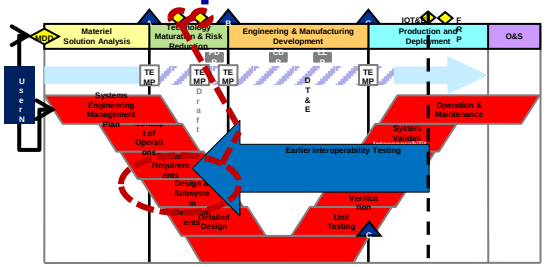


- **DoD Budget submission**

- ***Shift Left*** **Implementation underway**



T&E For SoS

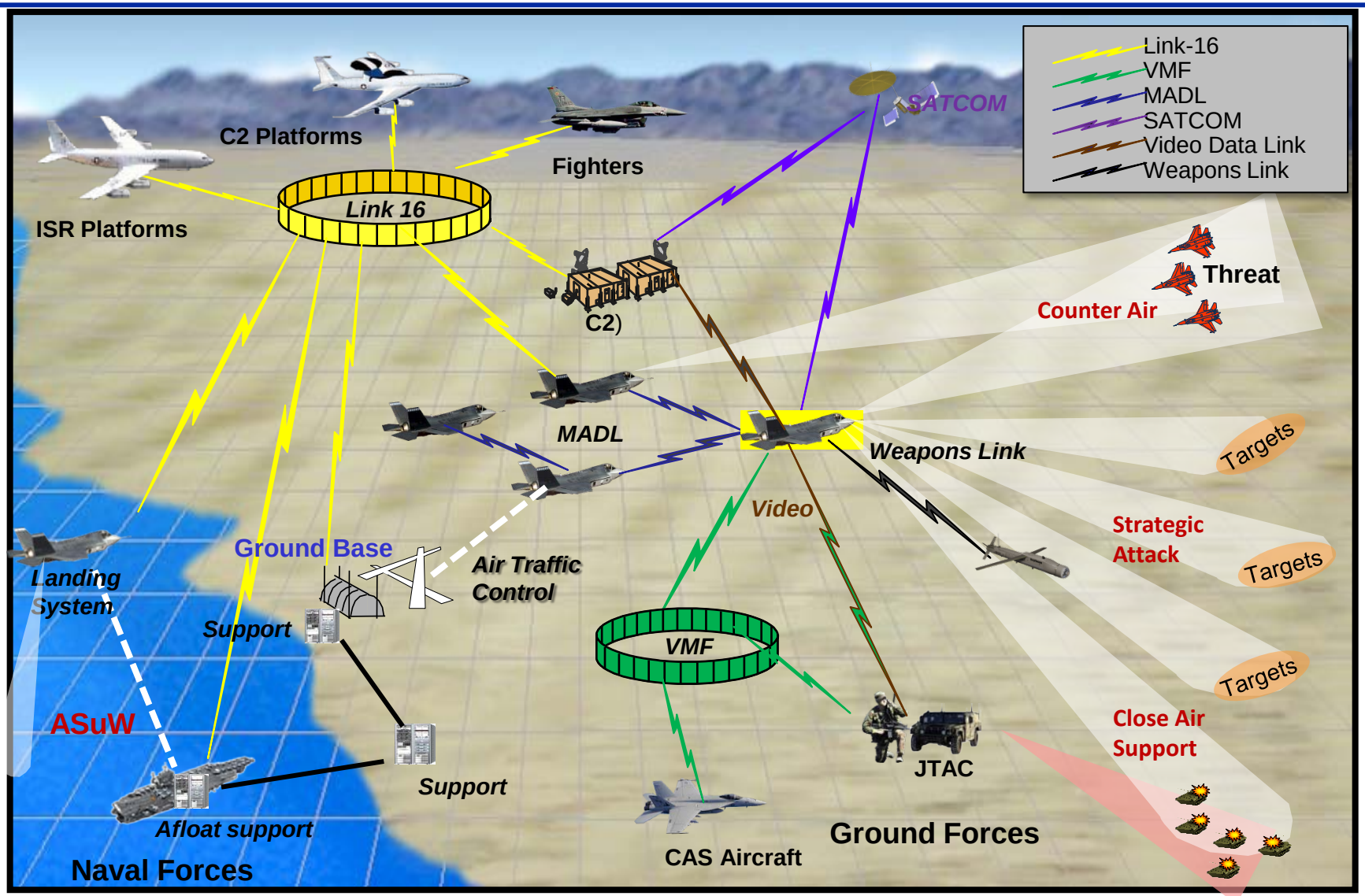
- **Interoperability**
  - Interoperability - the capability that makes creating SoS's possible
  - Quality designed into two or more systems so they work together
  - Related to the **technical** details that facilitate working together
  - An emphasis of DT&E
- **SoS**
  - Use/creation of an SoS is a commander's prerogative to achieve more for the warfighter.
  - Performance is **mission** oriented.
  - Does the use of this collection of systems give the warfighter a new or improved capability?
  - An emphasis of OT&E
- **Challenge**
  - How can DT&E both confirm interoperability and assure that the SoS will be found effective and suitable in OT&E?

Complexities of SoS Testing

- **Key Drivers:**
  - Competing POR development timelines,
  - Acquisition and range resources
  - Requirements and evaluation scope

Consider: System Virtualization and Distributed Testing

F-35 Interrelationships, Dependencies and Synchronization with Complementary Systems



P-8A Interrelationships, Dependencies and Synchronization with Complementary Systems

Of these 24 Interoperability Needs:
- Same PEO (2)
- " Navy Command (5)
- " Navy (6)
- " DoD/Govt (7)
- " National (2)
- " International (2)

And many more!

When do we know when success is achieved?
What is T&E's role when issues arise?

SoS SE and T&E Challenges [1]

- Challenges
  - High level SoS capability objectives
    - Asynchronous constituent system processes
  - Limited availability of constituent systems for SoS SE and T&E
  - Undefined Performance measures / assessment in the SoS context
  - SoS SE and T&E activities often unfunded
  - Difficult to assess individual system contribution to SoS capability

- Strategic Approaches
  - Apply SoS SE as framework for SoS T&E – stepwise integration and test
  - Address risk through evidence based T&E
  - Enterprise management
    - Allocation of SoS requirements
    - Schedule Synchronization
    - SoS funding

[1] "Systems of System Test and Evaluation Challenges", Dahmann, Rebovich, Lane and Lowry, IEEE SoSE, 2010

Vision

- Interoperability is essential to SoS capability
- Systems must:
  - Be engineered to interoperate to contribute the full capability of the system of systems
  - Interact through architecture and deal with dynamic configurations and missions
- Interoperability must be engineered in from the beginning

And it must be informed by DT&E.
Certification testing is TOO LATE!

I need your help!

- Testers:
  - Work closely with your Systems Engineering counterparts to ensure interoperability requirements are understood
- Requirements / Resource Sponsors:
  - Diligently translate CONOPS into detailed Interoperability requirements….and FUND THEM!
- Program Managers / PEOs:
  - Engage early up your Service chain of command and across the services to facilitate early interoperability engineering and planning
- Contractors / Primes:
  - Interoperability and SoS success must be the foundation of your system

YOU can help improve SoS Interoperability!

Questions

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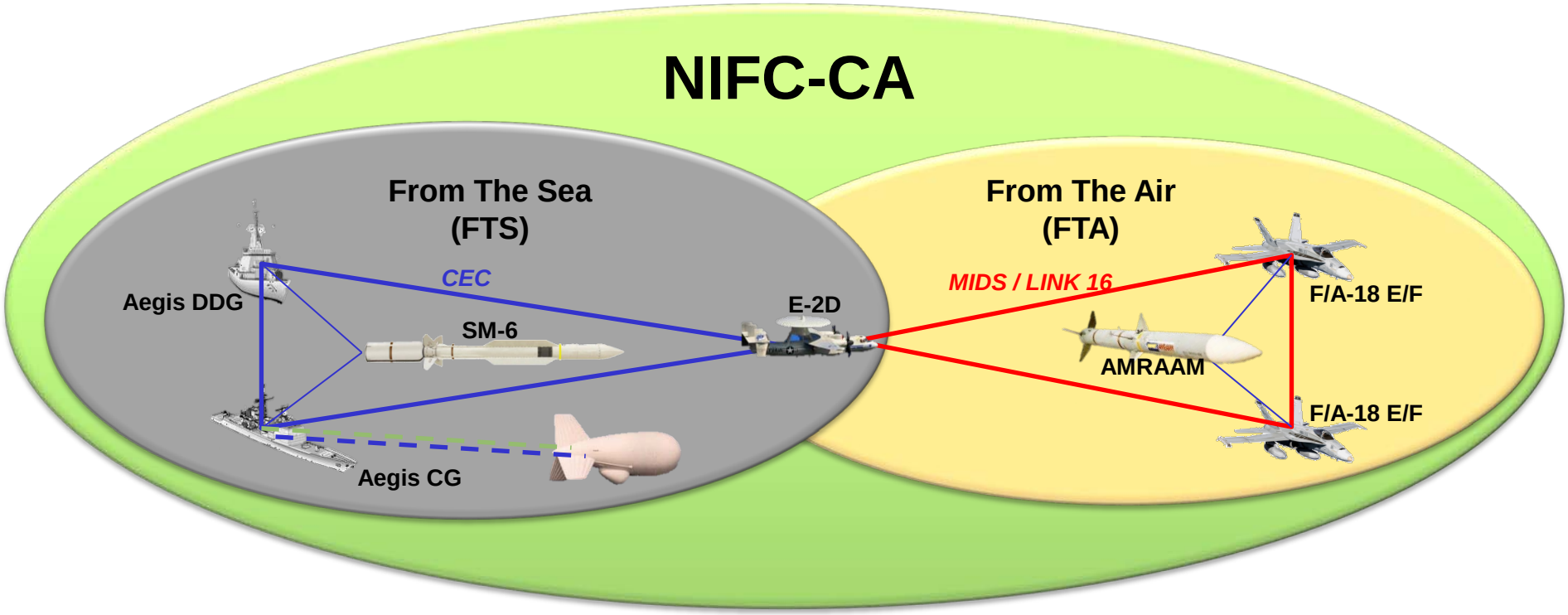
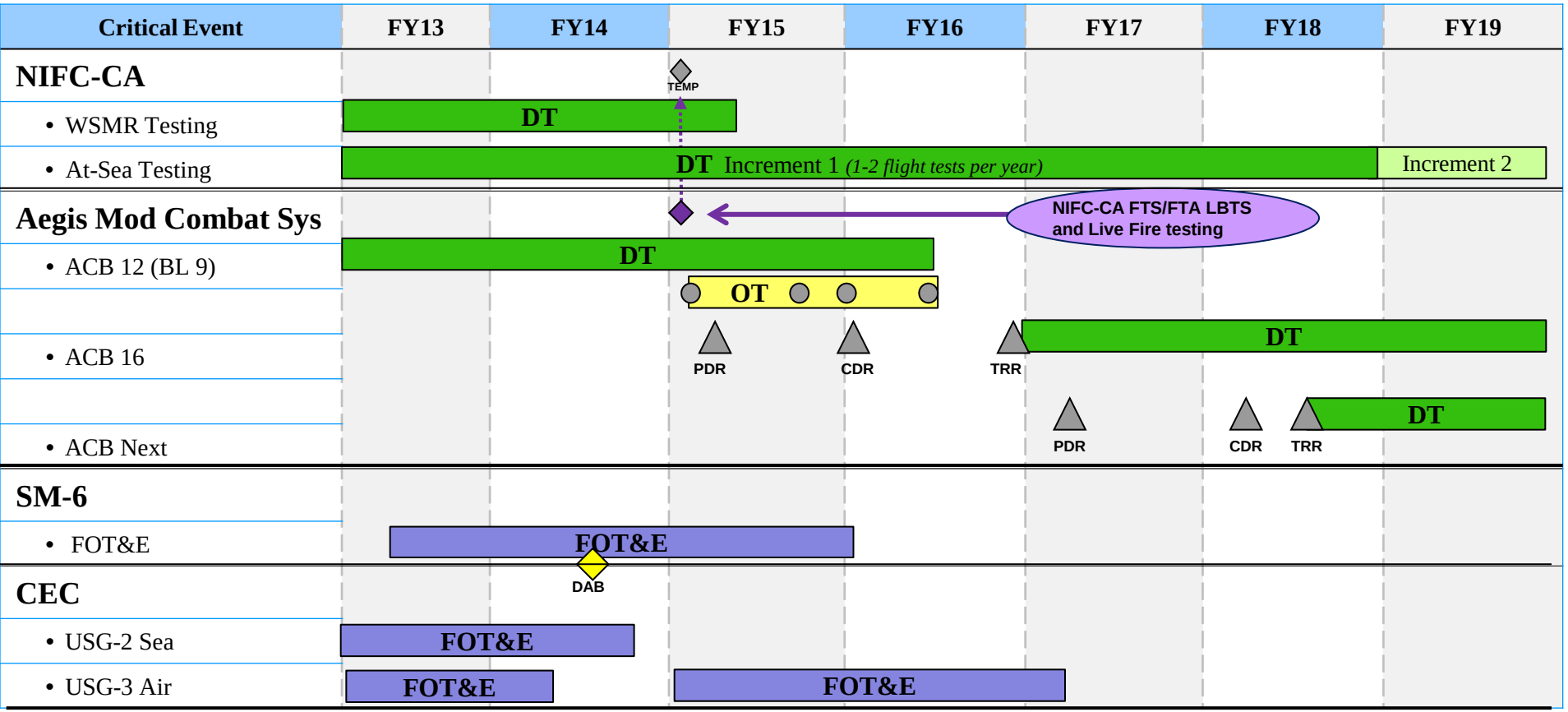
Navy Integrated Fire Control – Counter Air (NIFC-CA)

- Concept
  - Provide an Engage On Remote & Over The Horizon air defense capability, using full kinematic range of active missiles

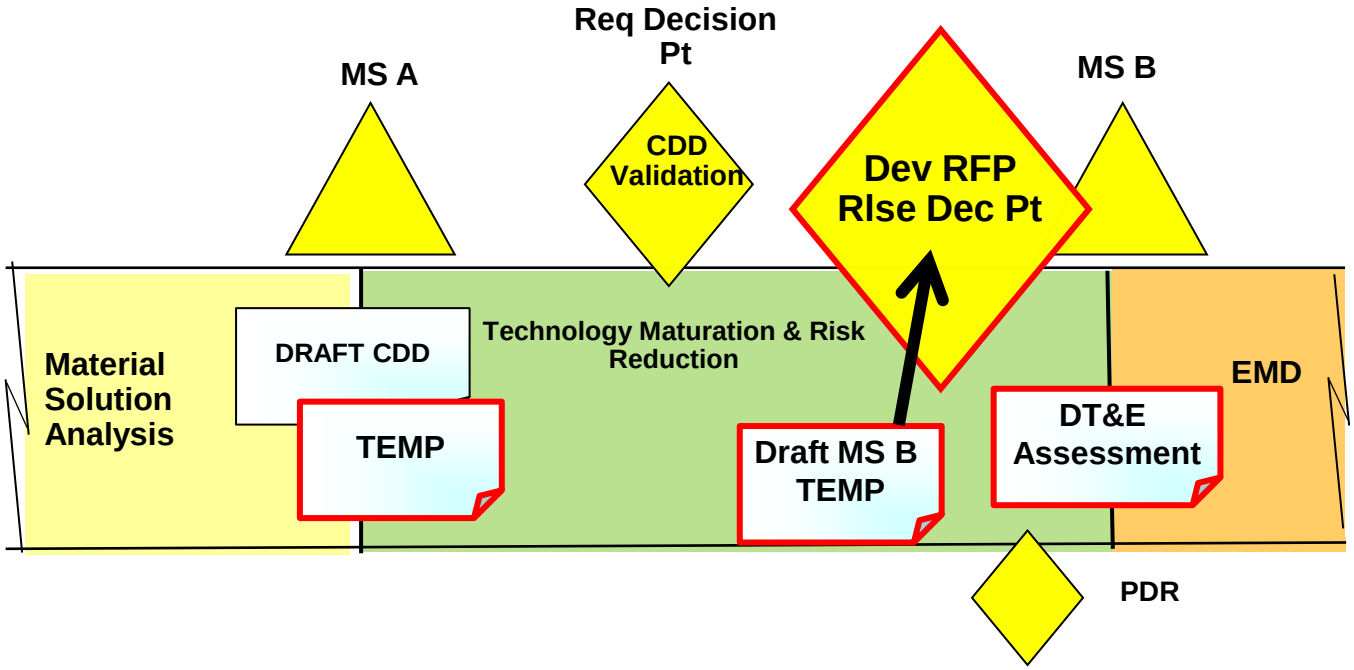


NIFC-CA FTS (Schedule View)



- Overall NIFC-CA system testing responsibility of PEO IWS 7.0
- Aegis Mod builds BL 9, ACB16, ACB Next are all Integrated Fire Control capable
- CEC testing focused on integration with E-2D and BL 9 and correction of deficiencies

"Focal Point" of Shift Left
(MS B TEMP ready at RFP Release)



- Development RFP Release Decision Point
  - MS B TEMP
    - Based on Developmental Evaluation Framework
    - Infrastructure status & needs (TRMC)

Another SoS Example
Army Tactical Network