



DoD LSI Transformation

Creating a Model-Based Acquisition Framework (MBAF)

Ron Carlson

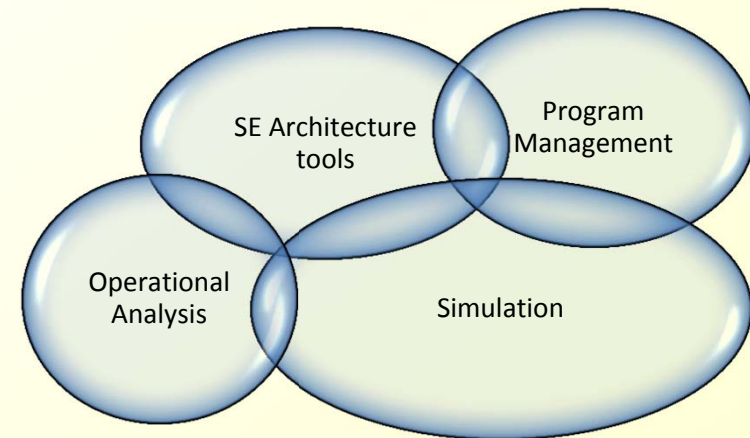
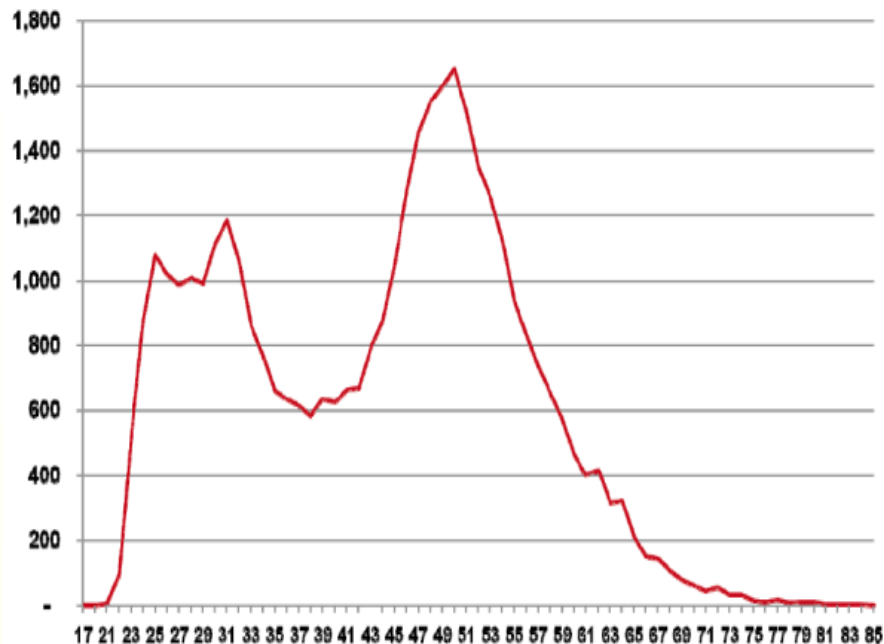
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Introduction

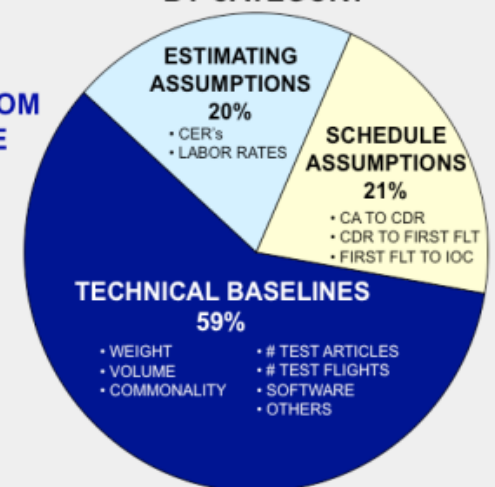


• Problem Motivation

- ACAT I – 12 years
- ACAT II – 8 years
- Lack of agility
- Schedule driven
- Document centric

AVERAGE RDT&E COST GROWTH FROM
ACQUISITION PROGRAM BASELINE
(ACROSS ALL PROGRAMS)
65%

DEVELOPMENT COST GROWTH BY CATEGORY





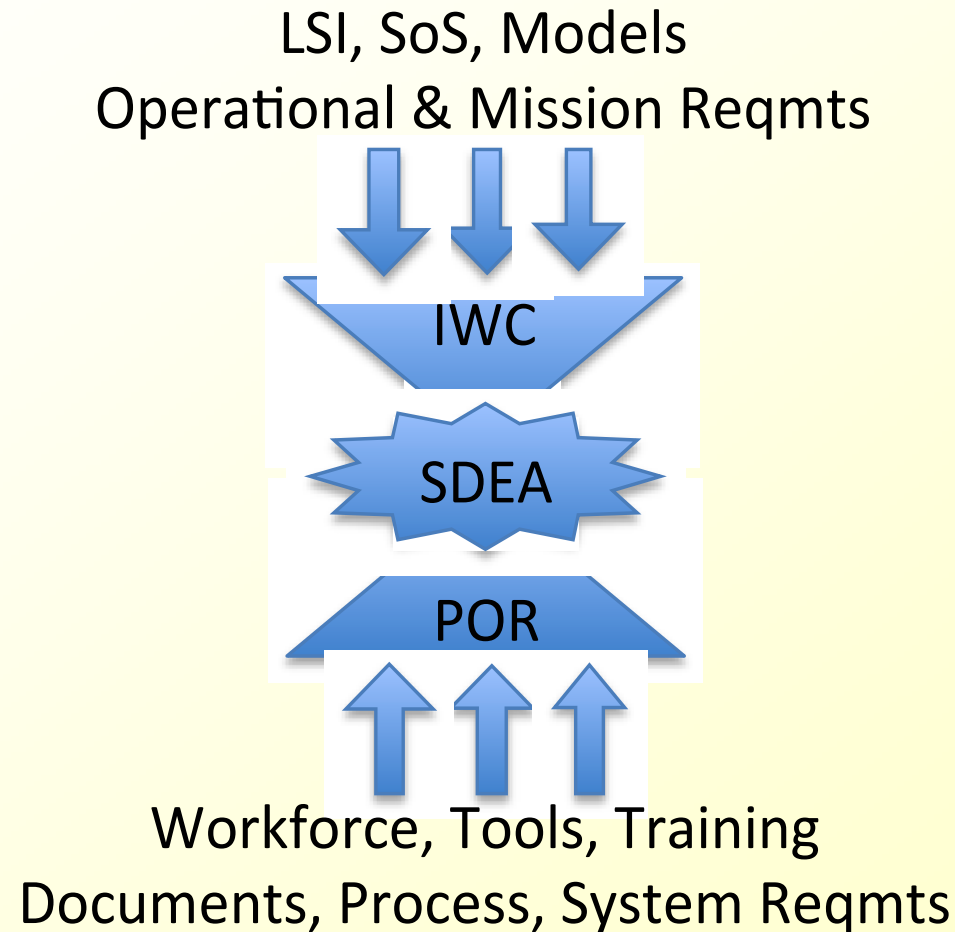
Background

- **Changes at NAVAIR**
 - Increased emphasis on becoming LSI
 - Helicopter program
 - UAV Program
 - NextGen Jammer Program
 - Mission Driven Acquisition
 - Integrated Warfare Concept (IWC)
 - Mission centric approach to defining operational requirements
 - Using MBSE

Need to interface POR MBSE to IWC MBSE



Background (cont)





Problem Statement

Problem

DoD does not have adequate Systems Engineering (SE) methods, processes, workflows, and/or tools that support the expansive Governmental role of the LSI in major weapons systems acquisitions or the ability to integrate with and develop the programs of record identified through the top-down IWC analysis process.

- How can the use of **MBSE tools** be applied to aid the program office in assuming more of the **LSI** role?
- What are the varied **SE methods and practices** in use across NAVAIR today?
- What is a **model** of the NAVAIR **acquisition process** in use today?
- What is an **integrated framework of tools** and MBSE methods that reflects the artifacts needed to integrate with the IWC and perform LSI roles?
- How can this new Model Based Acquisition Framework (**MBAF**) be applied to simulate or optimize process variations on programs?



SE LSI Skills

- Conduct **analysis** of broad system requirements and identify inter-dependencies
- Perform the SoS LSI role and deriving trade space to be held at mission level
- Ensuring SoS **optimization** and cross platform interoperability that provide traceability to mission level requirements.
- Define and control system **interfaces** consistent with the overall systems architecture – both in the SoS operational architecture, and in the related SoS views – to ensure required Mission level capability is delivered through deliberate system development as part of required SoS functionality.
- Develop the **System Architecture** must be developed by the Government (may not be outsourced) and also done without contracting for support with the Prime contractor or any major subsystem vendor. Government ownership of **system-level architectures** reduces possibility of proprietary or non-compliant contractor-specific architectures
- Control the technical trade space through preliminary design, to include budget, requirements, and schedule tradeoffs



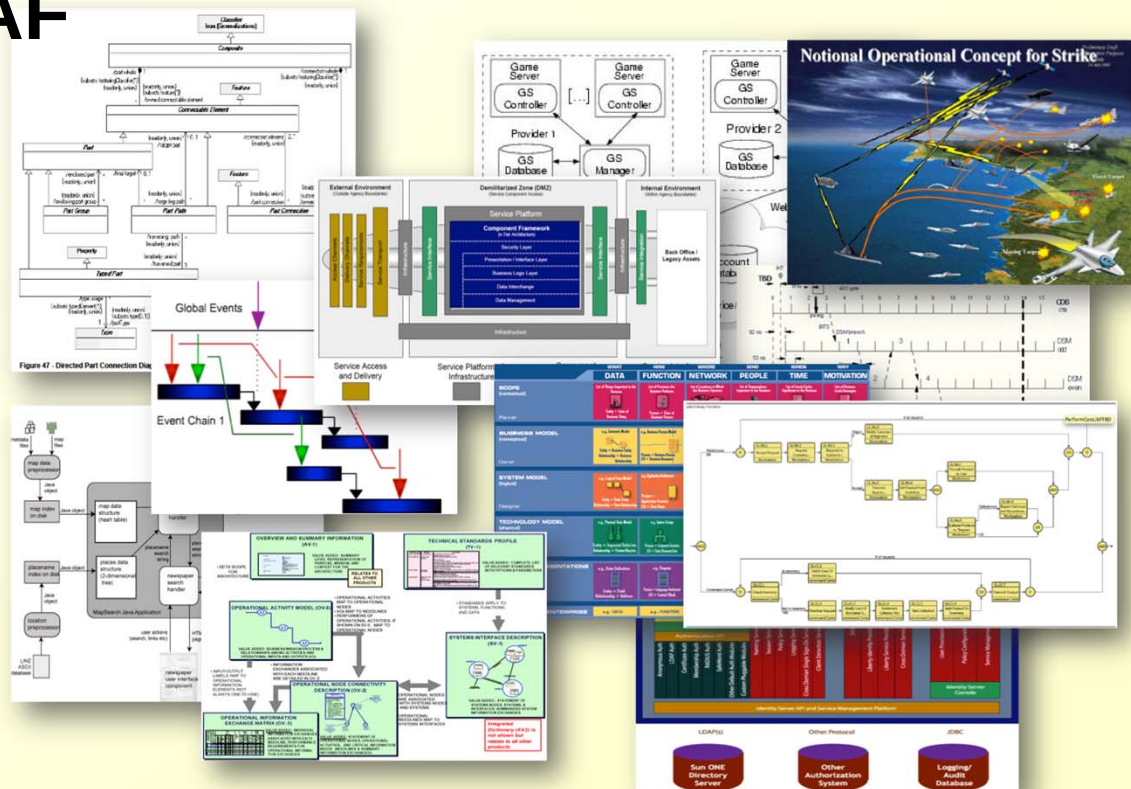
PM LSI skills

- Developing project schedules and **resource estimates** across multi-disciplined technical teams.
- Establishing and managing broad system **processes** that align **requirements** and interdependencies across program boundaries.
- Controlling the **trade space** through **preliminary design**, to include **budget, requirements, and schedule tradeoffs**
- Maintaining **traceability** of systems integration requirements to higher level mission objectives.
- Representing the system command at national **technical reviews**
- Exercising technical authority. Government is the **integrator** of major subsystems in the architecture as part of performing the LSI role.



Current Tools/Methodology

- Pockets of work ongoing
- No Consistent Application
- Many Tools Available
- UML/SysML/DoDAF
- Data Models
- Physical Models
- Domain Specific Languages (DSL)



(Derived from Estefan, 2008)



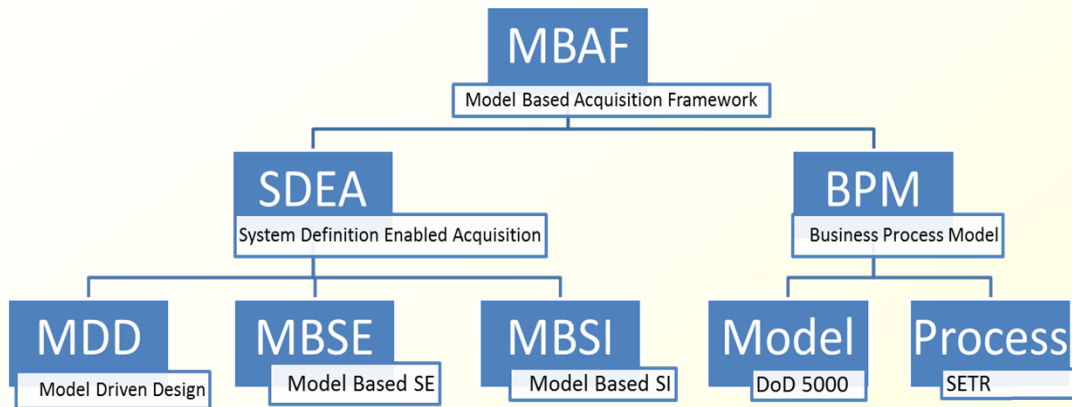
Proposed Methodology

- Develop a **model-based system** that could replace the current document, event-driven system that would add clarity to the design as it matured and would lead to the reduction in total acquisition time.
- Would allow **engineers** to “**see**” that the system meets their requirements would also be able to **demonstrate** that it would work.
- **Data-driven approach** would result in a model of the designed system that could be utilized for changes during development as well as system modifications after deployment, which would be an additional time savings over the total lifecycle.
- Ability to look up into the **IWC** and the **operational** requirements

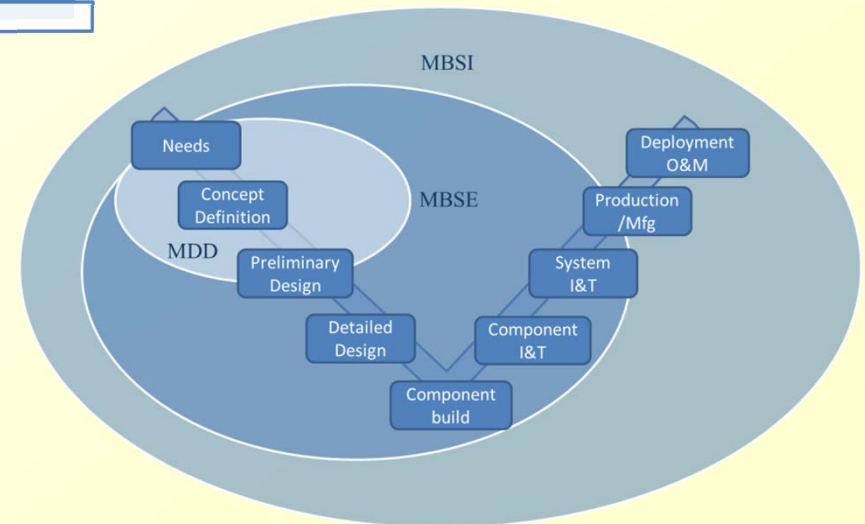


Approach

- **Create a Model Based Acquisition Framework**



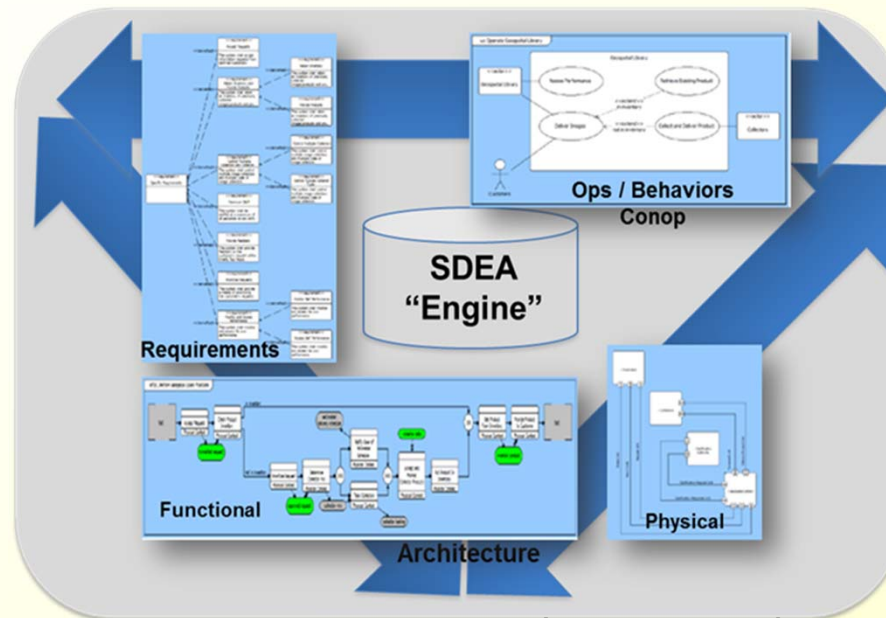
Identify the artifacts needed and the tools available to produce the artifacts needed to perform Technical reviews





System Definition Enabled Acquisition

- Initial Components of SDEA



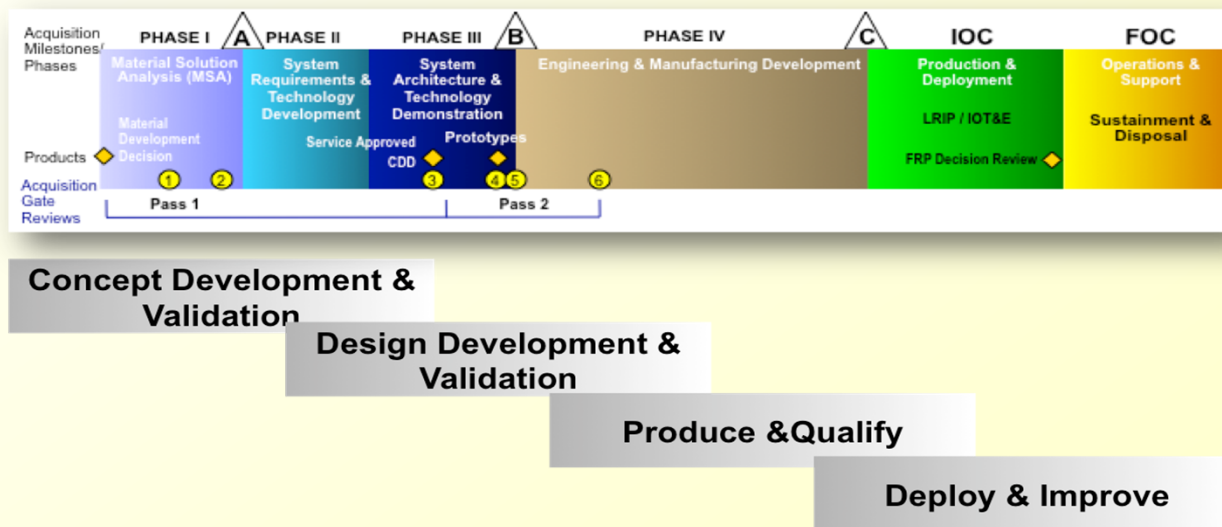
(Montgomery, Carlson 2013)

- Clearly defines and illustrates the requirements and CONOPS in a form that “shall” statements alone cannot
- Initial Architecture is functional, data driven linkage of the requirements and CONOPS



Progress to date

- **Data driven Model of NAVAIRs current acquisition procedure, the DOD 5000.02**
 - NAVAIR Systems Engineering Technical Review process
 - 300 artifacts reduced to 134 System Engineering artifacts



(Derived from DoD 5000)



Notations

- **CORE* as the modeling tool**
 - Items - SETR artifacts
 - Functions- SE Process steps or Engineering activities
 - Components- Acquisition Phases (DoD 500.02)
 - Interfaces - Engineering Documents
 - Packages - Tools in use today that create artifacts
- **Process definition from**
 - ISO 15288
 - Navy Systems Engineering Guide

**Vitech Corp. CORE MBSE tool*



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- ```

graph LR
 subgraph Inputs
 U[User Needs Statements]
 C[Initial Capabilities]
 R[Requirements]
 S[System Statement]
 end

 subgraph Processes
 P21[2.1 Define User Requirements]
 P22[2.2 Define Other Stakeholder Requirements]
 P23[2.3 Define and Derive System Requirements]
 end

 subgraph Outputs
 O1[Concept of Operations CONOPS]
 O2[User Problem Statements]
 O3[User Objectives Hierarchy]
 O4[System-level Conops]
 O5[System Decomposition]
 O6[Stakeholder System Requirements Data]
 end

 U --> P21
 C --> P21
 P21 --> O1
 P21 --> O2
 P21 --> O3
 P21 --> P23
 R --> P23
 S --> P23
 S --> P22
 P22 --> O6
 P23 --> O4
 P23 --> O5
 P23 --> P21
 P23 --> P22

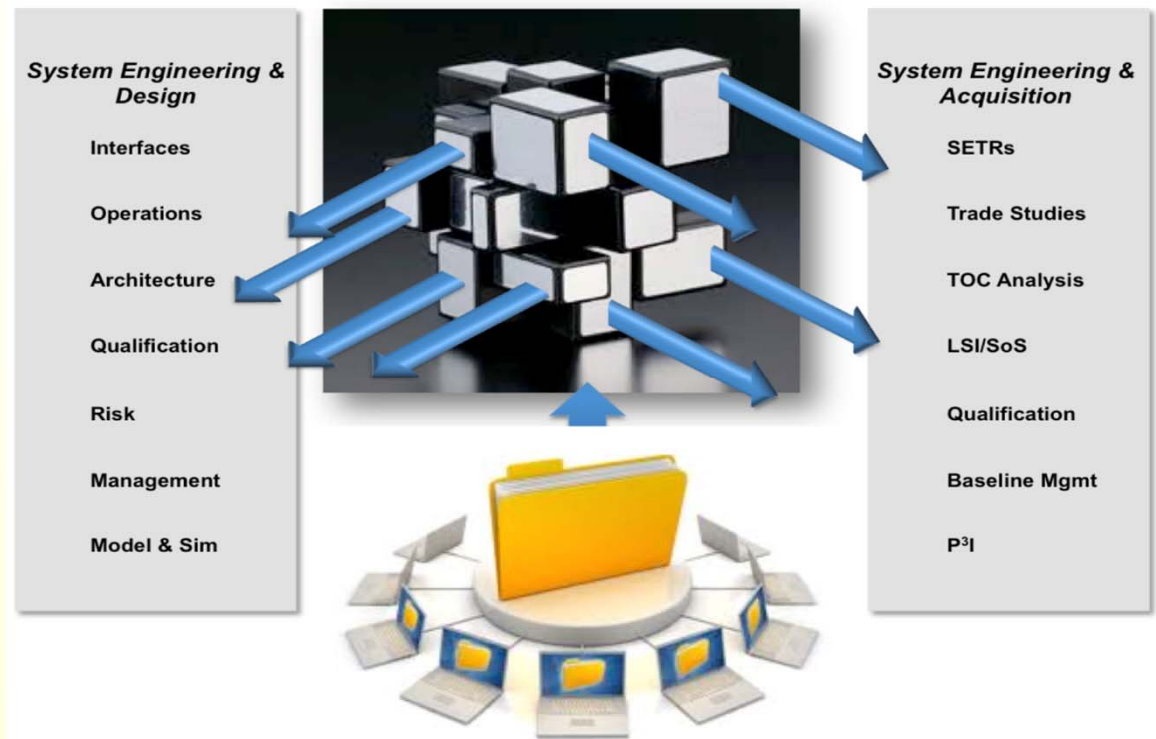
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# Conclusions/Future Research

- Detailed artifacts required to satisfy NAVAIR design reviews
- Insight into why artifacts are produced, what design question do they answer
- List of current tools that are used to produce artifacts
- Artifacts required by design phase
- Artifacts-Reason-Phase-Tool = MBAF
- Revolutionize the NAVAIR SETR process



(Montgomery, Carlson 2012)



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