

Headquarters U.S. Air Force

Integrity - Service - Excellence

Air Force Vision for Systems Engineering

**Systems and Software Technology Conference
Salt Lake City, UT
3 May 2006**



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Overview

- **Historical Perspective**
- **Visions**
 - *Life Cycle Systems Engineering*
 - *Life Cycle Software Policy*
- **Challenges**



Historical Perspective



U.S. AIR FORCE



“Systems Engineering is broken; go fix it.”

*Attributed to Dr. James G. Roche,
Secretary of the Air Force, Spring 2002*

Lack of Systems Engineering has been cited as the cause of major defense acquisition program failures

... as evidenced by ...

cost overruns, schedule slips, mishaps, external criticism, instability in requirements and funding, poor acquisition strategies ...

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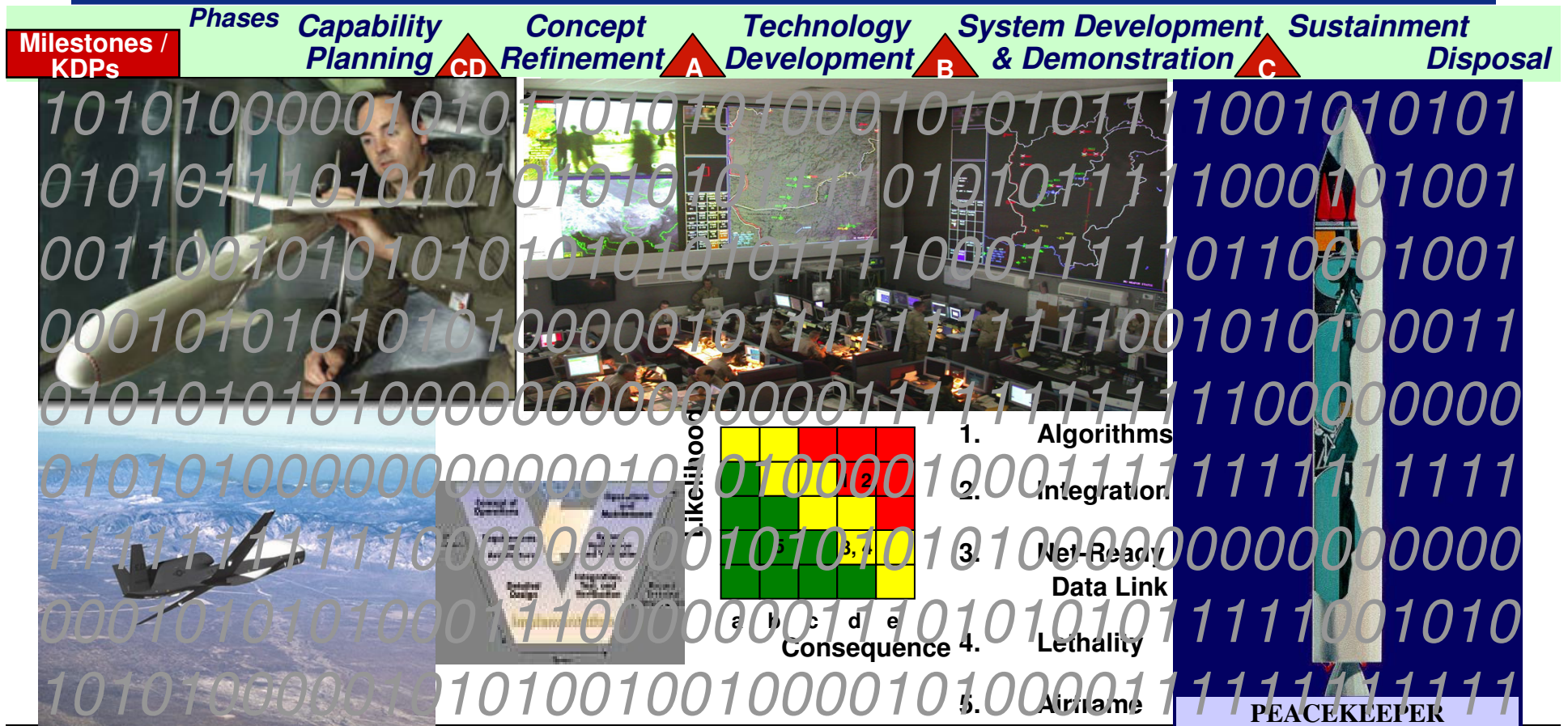


Historical Perspective Air Force & DoD, 2003-2005

- Apr 03: **SAF/AQ** policy memo on incentivizing contractors for better SE
 - Jan 04: **SAF/AQ** policy memo on revitalizing SE
 - Feb 04: **OUSD (AT&L)** policy memo emphasizing the importance of SE
 - Feb 04: **Air Force Center for Systems Engineering (CSE)** established at AFIT
 - Mar 04: **AT&L** policy memo requiring acquisition programs to develop and submit a Systems Engineering Plan (SEP) at MS and KDP Reviews
 - Sep 04: **SAF/AQ/US** policy memo on revitalizing software aspects of SE
 - Sep 04: **SAF/AQ** and **AFMC** host AF Conference on Advancing SE
 - Oct 04: **AT&L** policy memo establishing requirement for Chief Engineer position reporting to PEO
 - Oct 05: **SAF/AQ** policy memo establishing SEP review and coordination process, and identifying responsibilities for PEO Chief Engineers to ensure robust SE processes are in place
 - Dec 05: **AFI 63-1201, Life Cycle SE**, released to formal coordination
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Visions



- Disciplined Systems Engineering across the life cycle
- Software policy framework, with corresponding life cycle perspective, across the AF enterprise



Challenges

- **How to implement / facilitate the Life Cycle SE and software visions**
 - **Balancing depth and breadth of policy coverage across diverse communities (warfighter, HSI, CIO, ESOH, safety, *et al*)**
 - **Collaboration with industry and academia**
 - **Consistent SE application across domains (air, space, weapons, C2, IT)**
 - **SE for Systems of Systems (responsibilities, etc.)**
 - **Measures / metrics**
 - **Better preparing SE practitioners (SEP writing, etc.)**
-

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Air Force SE Vision -- Life Cycle Systems Engineering

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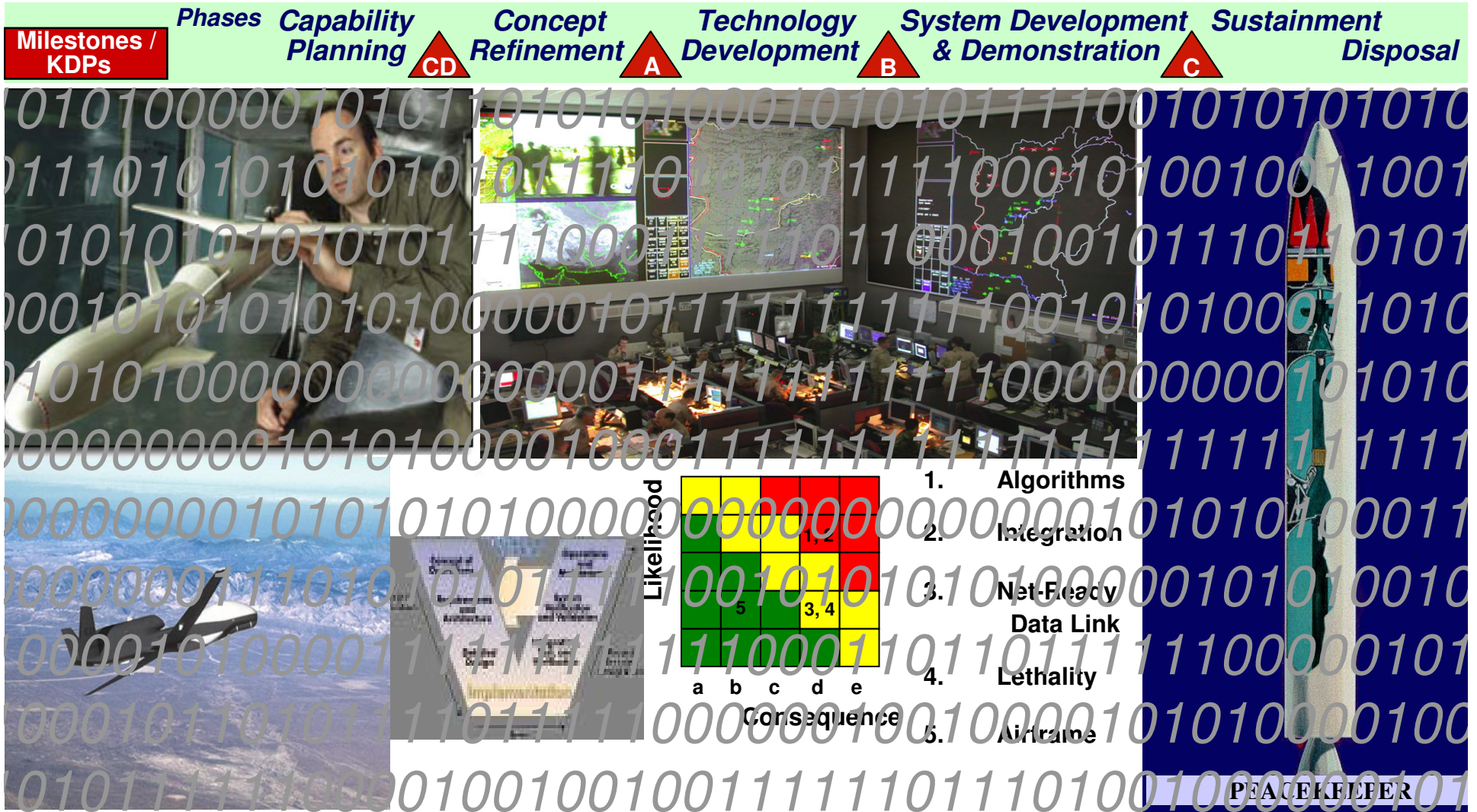


Overview

- **SE Throughout the Life Cycle**
 - **SE Prior to Milestone/Key Decision Point A**
 - **Early SE Pilots**
 - **Summary**
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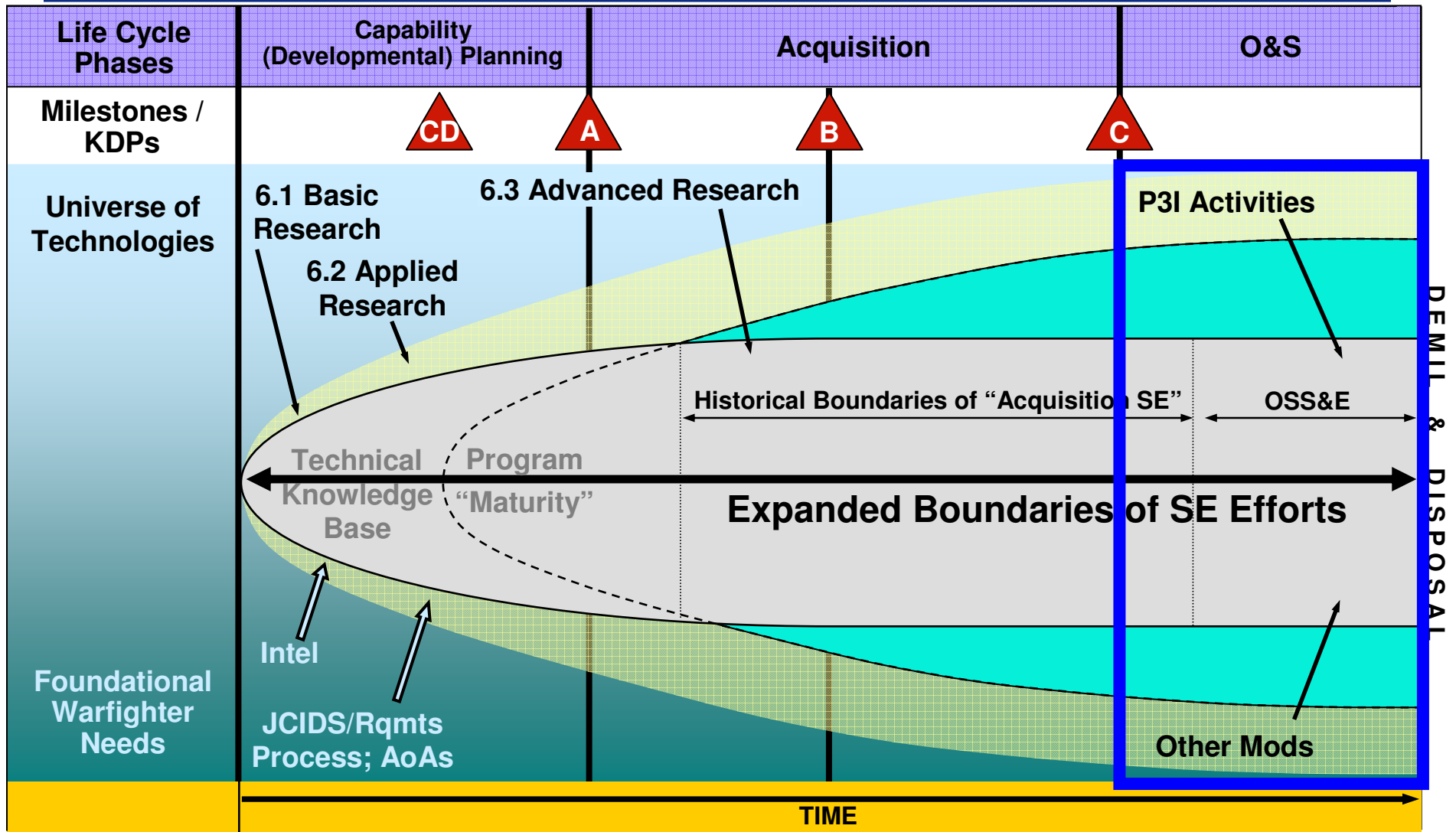


SE Throughout the Life Cycle





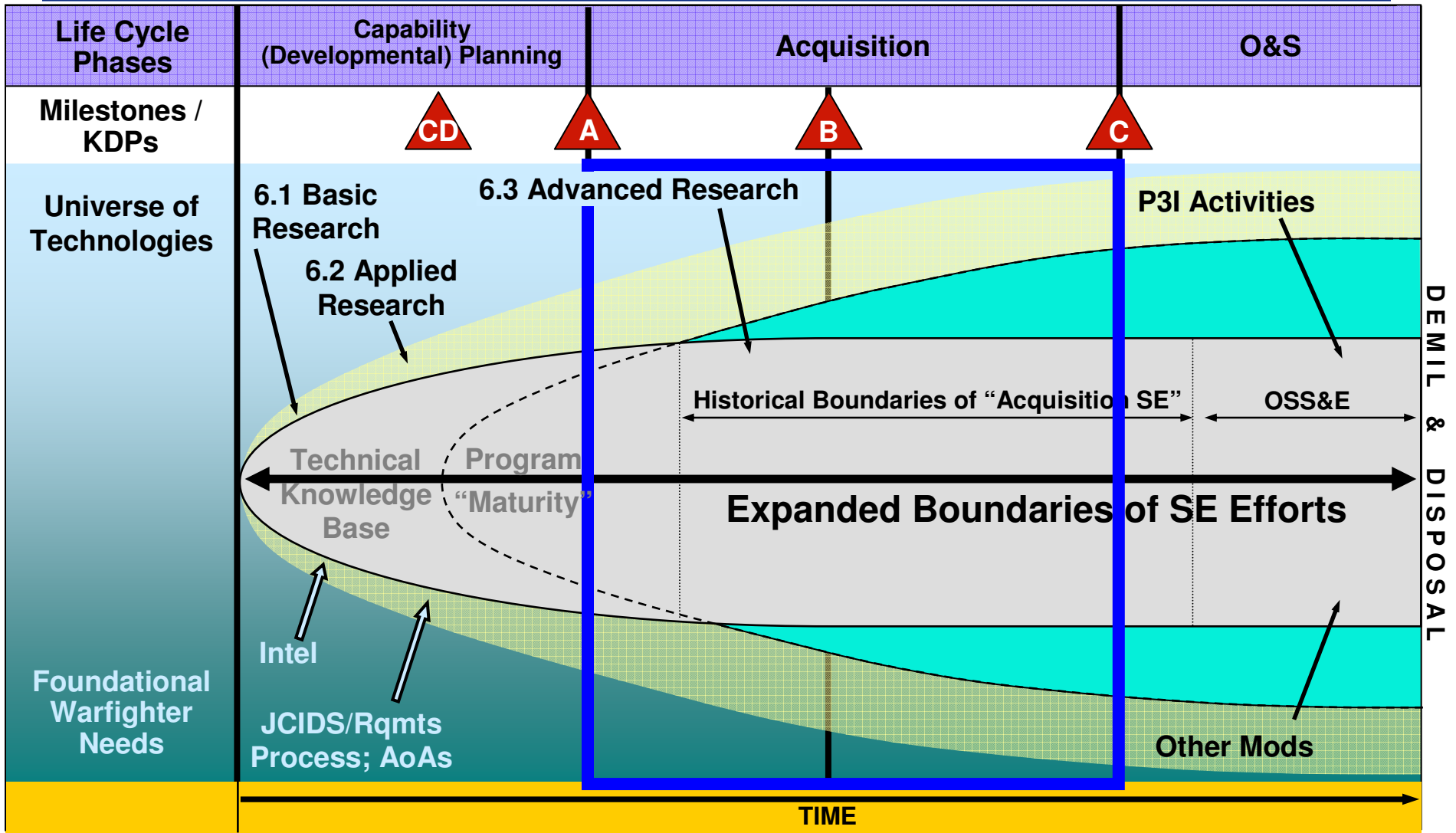
SE Planning in Sustainment OSS&E Plan





SE Planning in Acquisition

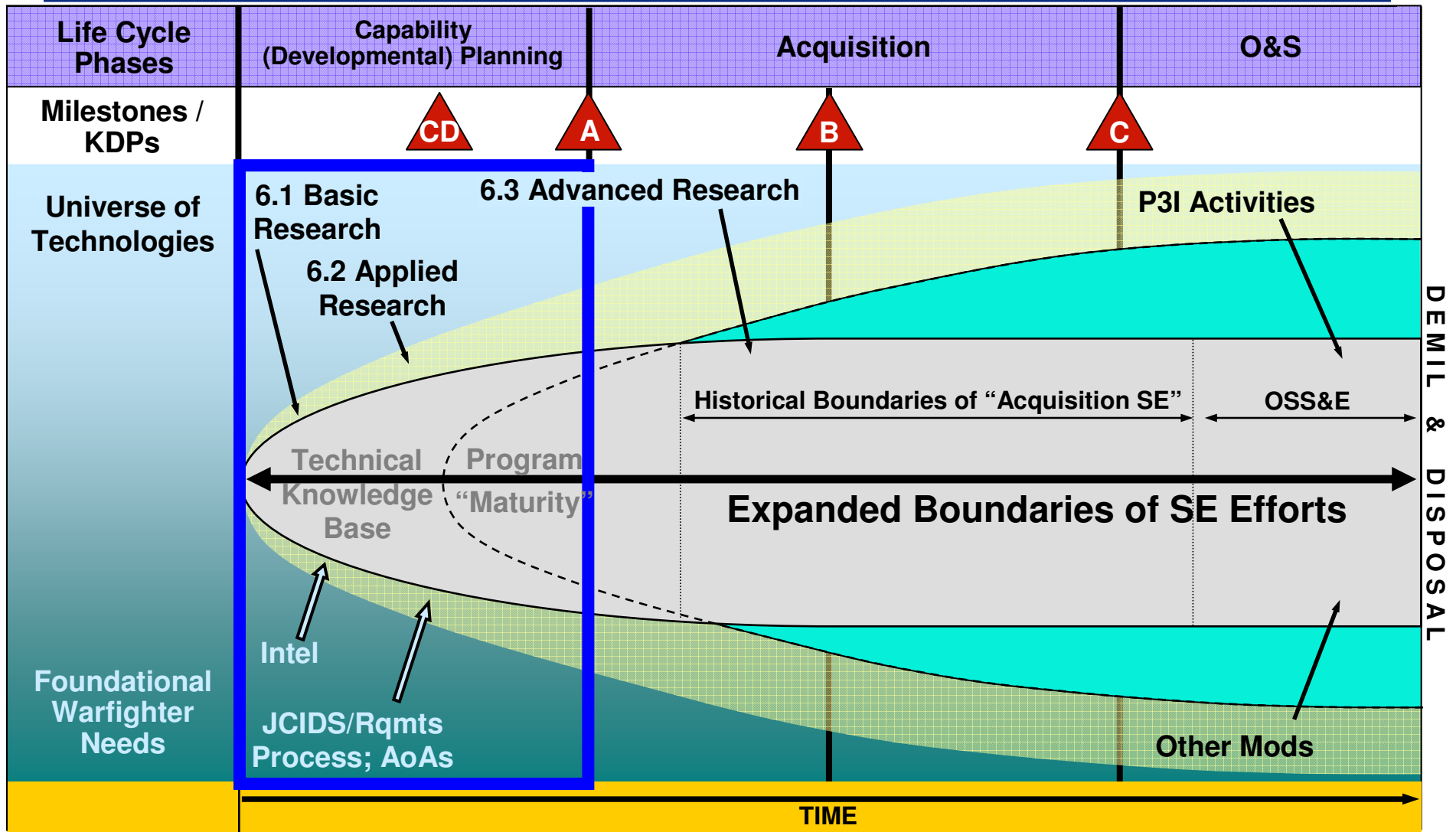
SEP





SE Planning in Pre-Acquisition

-- to be added --





Broad Interest in Pre-Acquisition Systems Engineering

Congress

- GAO reports (GAO-06-110, Nov 2005 “Better Support of Weapon System Program Managers Needed to Improve Outcomes”; several others)

OSD

- Policy coming -- AT&L calls it the “grey box”
- DDR&E sees it as the big “E” in DDR&E
- QDR language directs more linkage of concepts to Joint needs

USAF

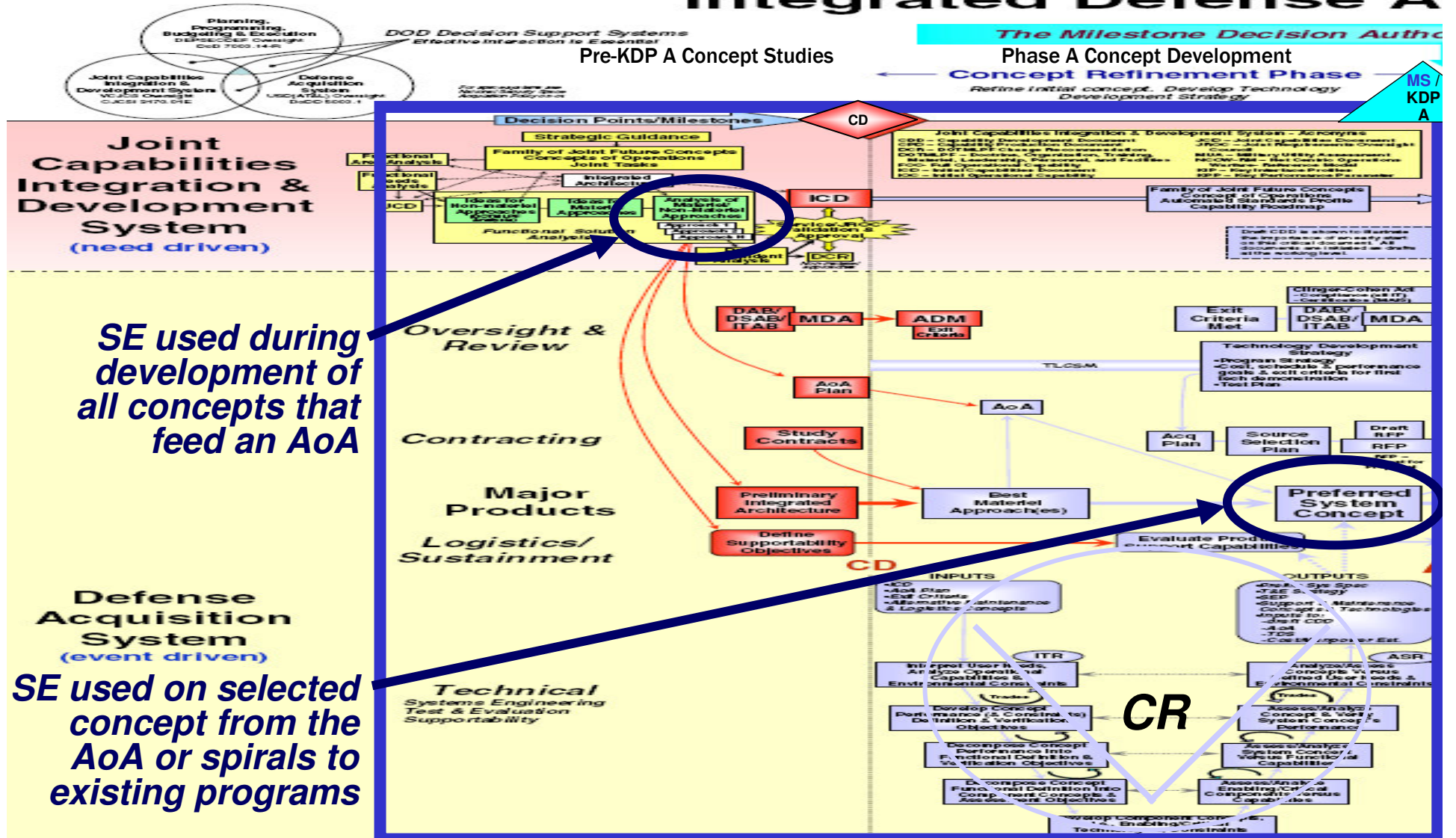
- Ad hoc and non-uniform application across MAJCOMs and Centers
- Quality of SEPs at MS/KDP A and B lacking rigor (and sometimes content)
- AFSO21 creates opportunities for enterprise re-engineering



Disciplined SE Required During Two Pre-Acquisition Activities

er. 5.2. August 2005

Integrated Defense A





Early SE Documentation

Two new SEP-like documents required from Centers

Pre-CD “C-SEP” (Concept SEP)

- Essentially a CONOPS between AFRL/XR and Product Center XR
- Lays out trade study process, decision criteria, methodology for populating knowledge base
 - Mission Needs Analysis and Mission Solution Analysis from AFSPC Integrated Planning Process generated 71 concepts for Operationally Responsive Space (ORS)
- Describes how SE processes translate “requirements” into concept designs / approaches that feed a specific AoA
- Describes how operational architectures drive these translations

Milestone / KDP A “A-SEP” (Alternative SEP)

- Developed by SPO Cadre (probably Product Center XR) for selected alternative
 - *e.g.*, Affordable Responsive Spacelift [ARES] Hybrid Launch Vehicle for ORS
- TDS will probably constitute 75% of the “meat” in this document
- Identifies how knowledge base will be further populated as the concept matures
- Approvals: Center Chief Engineer, PEO, SAF/AQ/US
 - Also OSD for ACAT ID



Early SE Pilots

Utilize pilots to scope policy

- **AFSPC nominated Advanced Infra-Red Satellite System (AIRSS) (Pre-MS/KDP B spiral to SBIRS program)**
- **AFMC nominated Very Small Missile (AAC)**

Incorporate new Pre-A SE policy into existing SE policy

- **Collect Lessons Learned; identify resources required to implement**
- **Incorporate into AFI 63-1201 “Life Cycle Systems Engineering” Increment 2 -- release in 2007**



Expectations

- **Disciplined Pre-A SE policy will:**
 - Flow Joint needs through concepts into programs
 - Link operational architectures to concepts to programs
 - Build technical knowledge base that migrates with concepts to program
 - Facilitate better decision-making at MS/KDP A and B
 - Integrate the “illities” up front into concept definition
- **Disciplined Pre-A SE policy will not:**
 - Provide guidance idea generation
 - Direct conduct of AoAs or EoA studies
 - Guide overall capabilities integration activities



Summary

- Disciplined SE is needed throughout the life cycle
- Pre-acquisition SE is an investment that will buy down risk in later phases of the program
- SMC and AAC have identified pilot efforts to scope pre-acquisition SE policy
- Lessons learned will be rolled into final policy and released under Increment 2 of SE AFI (63-1201)

ULTIMATE RESULTS

- Better technical planning, better integrated
- More confidence in programs entering acquisition

***"We demand rigidly defined areas
of doubt and uncertainty!"***



Douglas Adams,
*The Hitchhiker's Guide
to the Galaxy*

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Air Force Software Policy Vision

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Outline

- **Background – FY 2003 National Defense Authorization Act Section 804**
- **Development of AF software (S/W) acquisition policies**
- **Development of S/W policies across the AF**



FY03 National Defense Authorization Act Section 804 Air Force Implementation

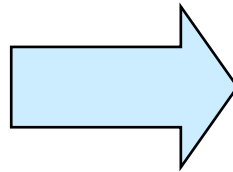
- **OSD & Services establish documented processes for:**
 - **S/W Acquisition Planning**
 - **Requirements Development and Management**
 - **Project Management and Oversight**
 - **Risk Management**
- **Metrics for performance measurement and continual process improvement**
- **Ensure that key program personnel have an appropriate level of experience or training**
- **Ensure adherence to established processes and requirements relating to the acquisition of S/W**

Improve Air Force S/W management and processes as an integral part of SE and Capability Acquisition



Air Force Acquisition Policy – Integrating S/W into SE processes

SAF/AQ/US Policy
Memo 04A-003,
20 Sep 2004:
***Revitalizing
the Software
Aspects of
Systems
Engineering***



Policy Memo Focus Areas

- **High Confidence Estimates**
- **Realistic Program Baselines**
- **Risk Management**
- **Capable Developer**
- **Developer Processes**
- **Program Office Processes**
- **Earned Value Management**
- **Metrics**
- **Life Cycle Support**
- **Lessons Learned**

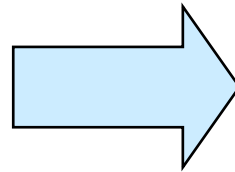
**Program Executive
Officers (PEOs)
Apply and Tailor
As Necessary**



Integrating s/w into SE processes – Implemented in AF acquisition guidance

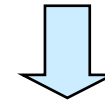
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Focus Areas

- High Confidence Estimates
- Realistic Program Baselines
- Risk Management
- Capable Developer
- Developer Processes
- Program Office Processes
- Earned Value Management
- Metrics
- Life Cycle Support
- Lessons Learned



**Jul 05 – implemented in AFI 63-101 (Capabilities
Based Acquisition System)**

**Being incorporated in AFI 63-1201 re-write (*Life-
cycle SE*)**



Need to Address S/W Policy and Guidance Across Air Force

■ Current state

- No overarching S/W policy and guidance
- Current S/W policies defined by functional elements
 - Difficult to know & comply with all policies
 - Conflicting, redundant policies

■ Where we need to be

- Identify S/W issues across AF needing AF guidance
- Define purpose and scope for AF S/W policies
- HAF S/W stakeholders collaborate to
 - Jointly address AF-wide S/W issues
 - Develop, promulgate appropriate AF S/W policies



Overarching S/W Policy – Must support all activities across AF

SAF/AQ & SAF/US (Acquisition)

- Policy & Guidance for Acquisition Programs
- Program Execution & Oversight for formal acquisition programs
 - Space, non-space, AIS
- Policies
 - DoD 5000
 - NSS AP 03-01
 - AF 63-XXX

SAF/XC (Warfighting Integration/CIO)

- Implements CCA
- Interoperability & interconnectivity
 - Policy and guidance
 - Standards and architectures
- Program Execution & Oversight for non-acquisition IT programs & procurements
- Policies
 - DoD 5200, 8500
 - AF 33-XXX



Overarching S/W Policy – Must support all activities across AF

SAF/AQ & SAF/US (Acquisition)

- Policy & Guidance for Acquisition Programs

-

**This is a “legacy” construct –
“WE” no longer have “us” and “them”**

- Policies
 - DoD 5000
 - NSS AP 03-01
 - AF 63-XXX

SAF/XC

(Warfighting Integration/CIO)

- Implements CCA
- Interoperability &

-

- Oversight for non-acquisition IT programs & procurements
- Policies
 - DoD 5200, 8500
 - AF 33-XXX



Overarching S/W Policy – Must support all AF domains

SAF/AQ & SAF/US Oversight

- Policy & Guidance for Acquisition Programs
- Program Execution & Oversight for formal acquisition programs
- Space, non-space, AIS
- Policies
 - DoD 5000
 - NSS AP 03-01
 - AF 63-XXX

Warfighting

- Implements CCA
- Interoperability & interconnectivity
- Policy and guidance
- Standards and architectures

Business

- Program Execution & Oversight for non-acquisition IT programs & procurements
- Policies

Infrastructure

- DoD 5200, 8500
- AF 33-XXX

SAF/XC Oversight



Overarching S/W Policy – Must support all AF domains and all AF systems

SAF/AQ & SAF/US Oversight

SAF/XC Oversight

Warfighting



Business



Infrastructure





Disciplined LC Framework for AF S/W Policy – A SAF/AQR & SAF/XC Top Priority

- **Purpose: establish framework and mechanism for the joint development & promulgation of appropriate AF S/W policies**
 - **Near & Mid Term**
 - **Develop software Life Cycle (LC) framework**
 - **Define LC phases common to all S/W**
 - **Identify unique elements within different S/W domains**
 - **Conduct S/W LC framework gap analysis**
 - **Develop S/W Policy Framework – Identify & prioritize areas in S/W LC needing AF S/W policies**
 - **Long Term – institutionalize process**
 - **Determine appropriate policy documents for AF guidance**
 - **Leverage existing venues (e.g. SSTC) for information exchange**
- **Optimize value and ease of use of AF S/W Policies**
 - **Encourage using cross-cutting disciplines in S/W LC**
-