Air Force Materiel Command

Developing, Fielding, and Sustaining America's Aerospace Force

Implementation of Policy Requiring Systems Engineering Plans for Air Force Programs – Results and Implications

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Objective

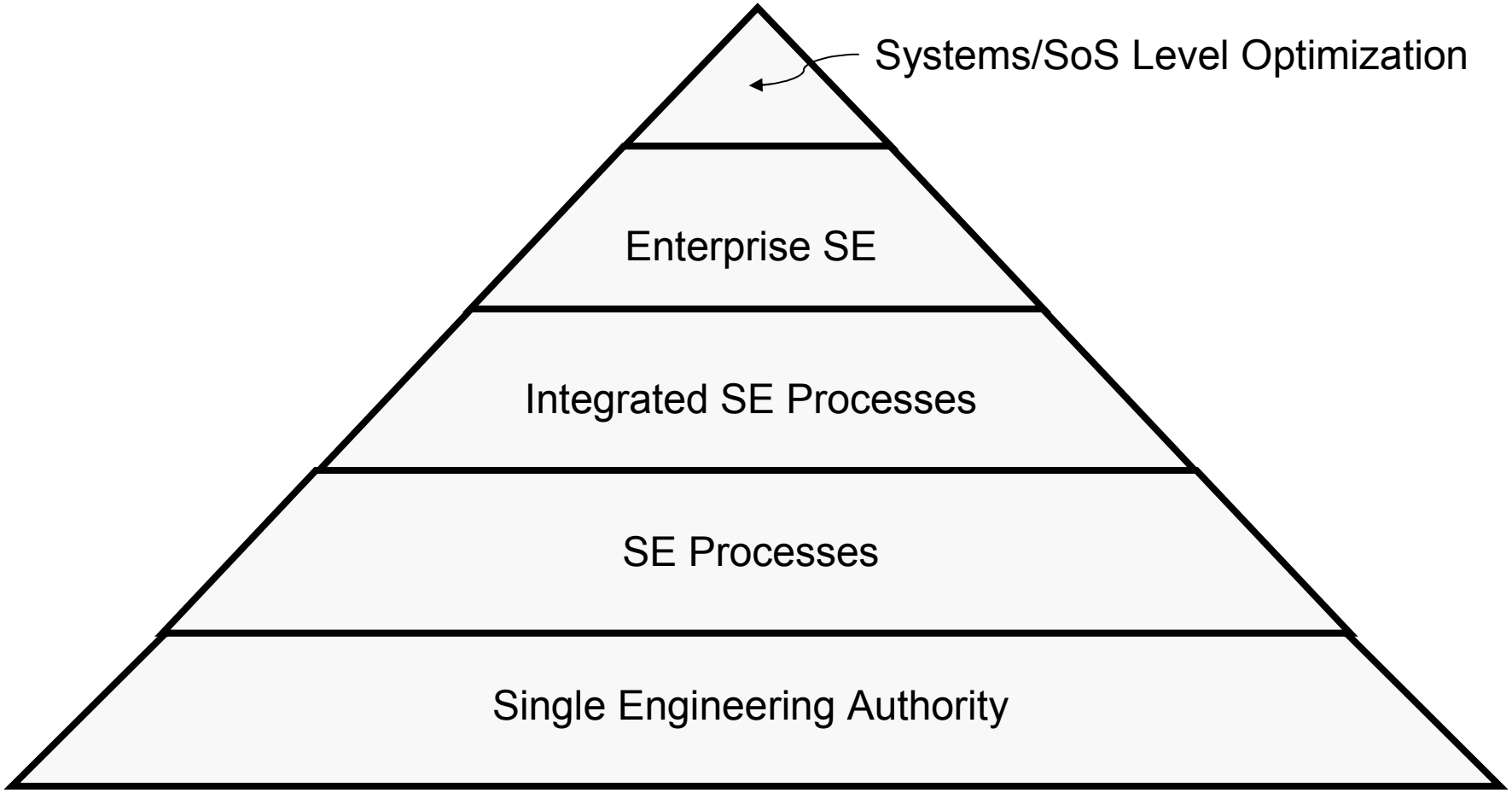
- Summarize and assess results of SEP reviews to date
  - SEP represents what is, not what should be
  - A measure of how well the revitalization of SE is going

State of the Practice vs State of the Art

Overview

- Background – policy, programs, reviewers
- Review results
- Implications
- Recommendations

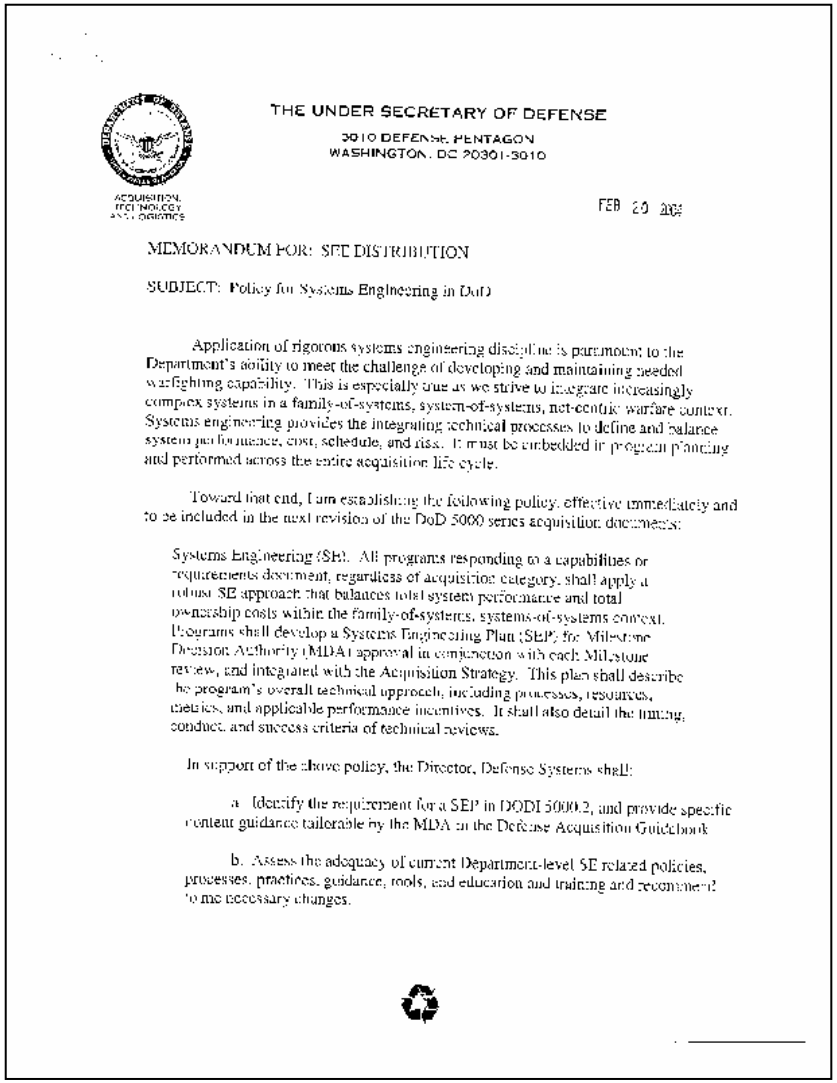
SE Implementation Hierarchy



Apologies to Maslow

Policy

- Policy Memo
  - Feb 04
- Draft AFI



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ACQUISITION, TECHNOLOGY AND LOGISTICS

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MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Policy for Systems Engineering in DoD

Application of rigorous systems engineering discipline is paramount to the Department's ability to meet the challenge of developing and maintaining needed warfighting capability. This is especially true as we strive to integrate increasingly complex systems in a family-of-systems, system-of-systems, net-centric warfare context. Systems engineering provides the integrating technical processes to define and balance system performance, cost, schedule, and risk. It must be embedded in program planning and performed across the entire acquisition life cycle.

Toward that end, I am establishing the following policy, effective immediately and to be included in the next revision of the DoD 5000 series acquisition documents:

Systems Engineering (SE). All programs responding to a capabilities or requirements document, regardless of acquisition category, shall apply a robust SE approach that balances total system performance and total ownership costs within the family-of-systems, systems-of-systems context. Programs shall develop a Systems Engineering Plan (SEP) for Milestone Decision Authority (MDA) approval in conjunction with each Milestone review, and integrated with the Acquisition Strategy. This plan shall describe the program's overall technical approach, including processes, resources, metrics, and applicable performance incentives. It shall also detail the timing, conduct, and success criteria of technical reviews.

In support of the above policy, the Director, Defense Systems shall:

a. Identify the requirement for a SEP in DODI 5000.2, and provide specific content guidance tailorable by the MDA in the Defense Acquisition Guidebook

b. Assess the adequacy of current Department-level SE related policies, processes, practices, guidance, tools, and education and training and recommend the necessary changes.

About the Programs

- Non-Space AF programs at a milestone
  - Small # of programs
- Numerous other programs
  - Starting SEPs
  - Asking questions
  - Quick reviews

Air Force Reviewers

- SAF/ACE and AQR
- Extended Staff
  - AFMC/EN
  - AF Center for Systems Engineering

Areas Studied

- Requirements definition
- Processes
- Risk
- Key Performance Parameters
- Enterprise SE
- Multiple Reviews
- Authorship
- SEP Size

Requirement Definition

- 60% of programs adequately defined their requirements below the ICD/CDD
- Many programs can point to a “textbook” requirements analysis/decomposition process
- Few can point to a configuration controlled specification

Quotes

“We don’t have any requirements”

Processes

- 27% of programs described processes
- The rest either
  - Don't have a process
  - Don't know the process

Process 101

If you can't document the process
You don't have one

Risk

- 55% of programs defined their risks
- The rest
  - Simply don't know what the risks are
  - Not a integral part of the program

Quotes

"I can't list my risks in the SEP. They change daily"

"Why do you need to know what the program risks are to do SE planning"

Key Performance Parameters

- 73% of the programs list KPPs
  - KPPs are clearly stated as a SEP requirement

Quotes

"What have KPPs got to do with SE?"
"I can't list all of my program's KPPs in the SEP. We have hundreds"
"I don't have any KPPs"

Scheduled Design Reviews

- 55% of programs have entry and exit criteria for design reviews

Quotes
“ We are not there yet”

Enterprise SE

- 10-20% of programs have fully integrated SE processes into program
  - Risk
  - EVMS
  - Design reviews
  - Manning

Multiple reviews

- Few programs approved without multiple iterations
- Approvals with comments

Authorship

- SEPs written by
  - Prime contractor
  - Task order contractor
  - Reserve Officer
  - Junior members of program

Big SEPs

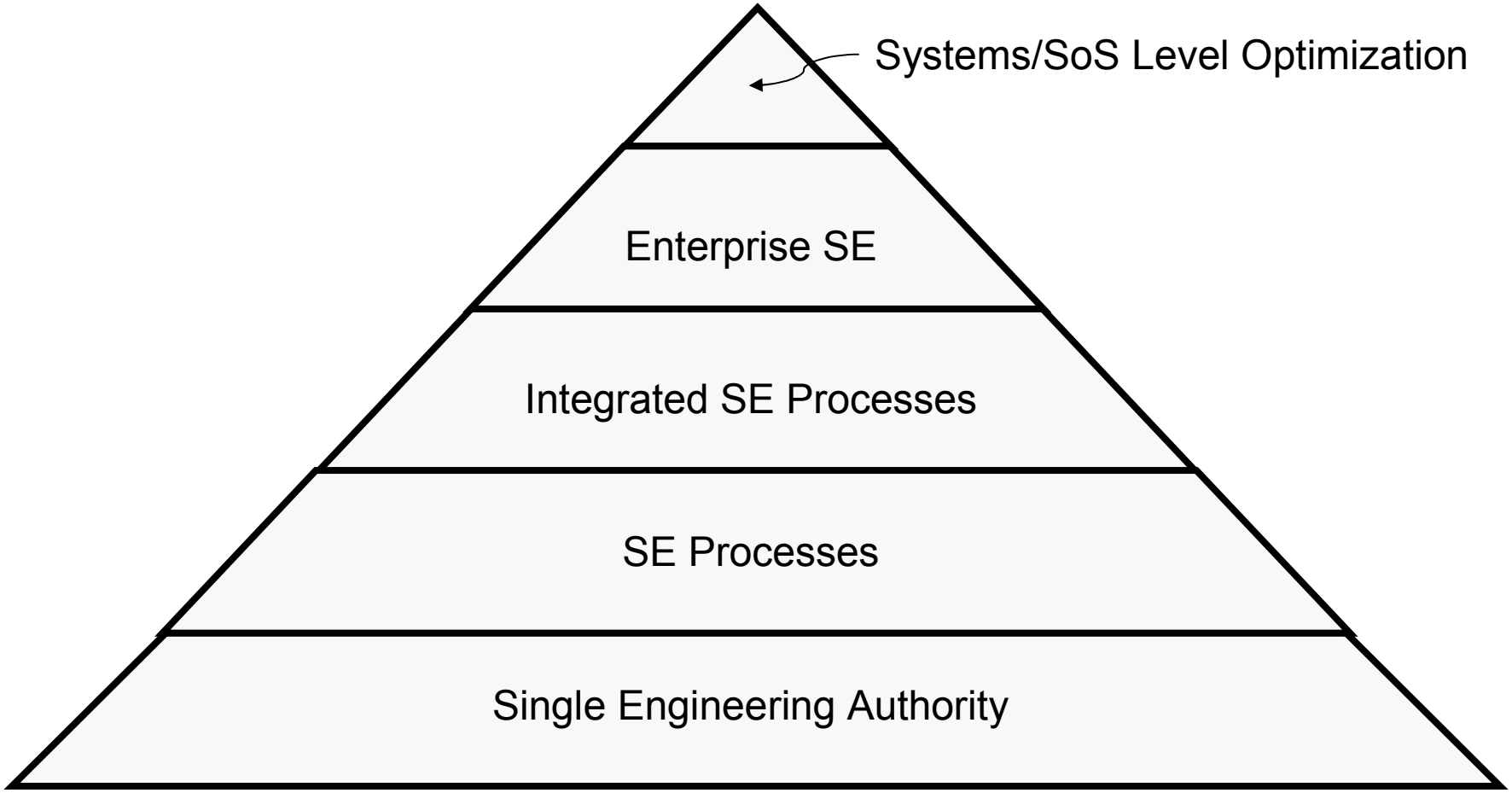
- Don’t know what “they” want
- Don’t know what my program is doing
- Give “them” lots of stuff and hope they stumble over what they want
- Tutorial

State of the Practice

- Not @ 100% in any of the areas reviewed
  - Requirements definition
  - Processes
  - Design reviews
- Shortfall is in SE fundamentals

State of the practice well below the state of the art

SE Implementation Hierarchy



Results - Possible Factors

- Requirement to document SE planning in a SEP is new
- Format confusion
  - What do they really want?
- Years of negative learning

Atrophied SE Talent

- AFMC has half the number of engineers as in the early 80s
- Engineers hired in the last decade+ were trained in a less disciplined SE environment
- SE talent still exists in AF/center
  - Generally at a higher level
- That limited talent is probably not working on the program

Consultants can only do so much

Implications - More Help

- SEPs indicate continuing, significant problems with the implementation of SE
- The powers that be will “Inspect in good SE”
  - Wing, Group, Squadron, PEO/Center, SAF/AQ

What gets inspected gets improved

Implications-SEP as Audit Tool

- More status will be required in SEPs
- Approval with comments
  - Update in 90 – 120 days

Recommendation

- Continue this type of analysis
  - Across programs and over time
- Develop PEO checklists
  - Start with OSD SEP checklist
  - Tailored/specific to product line
- Require just-in-time training
  - Event/milestone

Questions