
# *Revitalizing Education and Training in Systems Engineering*

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# Outline

- Mission Statement
- Systems Engineering Policies
- Education and Training
- Systems Planning, Research, Development, and Engineering (SPRDE) Career Field Update
- Core Plus
- The Way Ahead…

# Systems and Software Engineering Mission Statement

- **Shape acquisition solutions and promote early technical planning**
- **Promote the application of sound systems and software engineering, developmental test and evaluation, and related technical disciplines across the Department's acquisition community and programs**
- **Raise awareness of the importance of effective systems engineering and drive the state-of-the-practice into program planning and execution**
- **Establish policy, guidance, best practices, education, and training in collaboration with academia, industry, and government communities**
- **Provide technical insight to program managers and leadership to support decision making**

***Driving Technical Excellence into Programs!***

# System Engineering Policies

**All programs shall develop a SE Plan (SEP)**

**Each PEO shall have a lead or chief systems engineer who monitors SE implementation within program portfolio**

**Event-driven technical reviews with entry criteria and independent subject matter expert participation**

**OSD shall review program's SEP for major acquisition programs (ACAT ID and IAM)**

**Technical Planning**

**Technical Leadership**

**Technical Execution**

**Technical Excellence**

***Strong technical foundation is the value of systems engineering to the program manager***

# What's Coming in Policy

- **Codified SE revitalization in DoDI 5000.2**
  - **Captures previously approved SE and related policies**
  - **Mandates SEP at Milestones A, B, and C**
  - **Considers SE during Concept Refinement and Technology Demonstration phases**
  - **Mandates system-level Critical Design Review, sets CDR exit criteria, requires a CDR report to Milestone Decision Authority**
  - **Establishes functional, allocated, and product baselines during SDD**
  - **Mandates Program Support Reviews for all MDAPs**
  - **Establishes requirement for Configuration Management and Data Management strategies**

# SE in Defense Acquisition Guidebook

- **SE guidance to acquisition community—Chapter 4**
  - **Best practices for "applied" SE**
    - **SE processes (8 technical management, 8 technical)**
    - **Guide for each acquisition phase, concept refinement through disposal**
  - **Linkage of SE products and processes to acquisition objectives and decision points**
  - **Currently being updated**

**http://akss.dau.mil/dag/welcome.asp**

# *Education and Training*

# Education &Training Background

- In October 2003, an Education and Training Summit found that while SE processes were sound, their application in acquisition programs was often lacking in rigor.
- Among other initiatives, the Director, DS/SE, (now SSE/ED) issued a directive to re-baseline the SE competencies and curriculum for the SPRDE/SE career path.
- The SPRDE/SE FIPT, working with the Institute for Defense Analysis, developed almost 200 learning outcomes to serve as a basis for the new curriculum.
- The new curriculum was structured to focus on the 16 DoD SE processes at Level I, 5 SE phases at Level II, and leadership and management skills at Level III.
- From August 2004 until February 2007, DAU developed four new courses: SYS 101, SYS 202, SYS 203, and SYS 302.

# Education & Training (SYS 101)

- **SYS 101: Fundamentals of Systems Planning, Research, Development and Engineering**
  - **Technically rigorous, comprehensive online course that provides an introduction to systems engineering.**
  - **Based around the 8 technical management processes and the 8 technical processes outlined in the Defense Acquisition Guidebook.**
  - **Also suitable for personnel in technical management and program management positions who want to understand more about systems engineering and the details of its processes.**

# Education & Training (SYS 202)

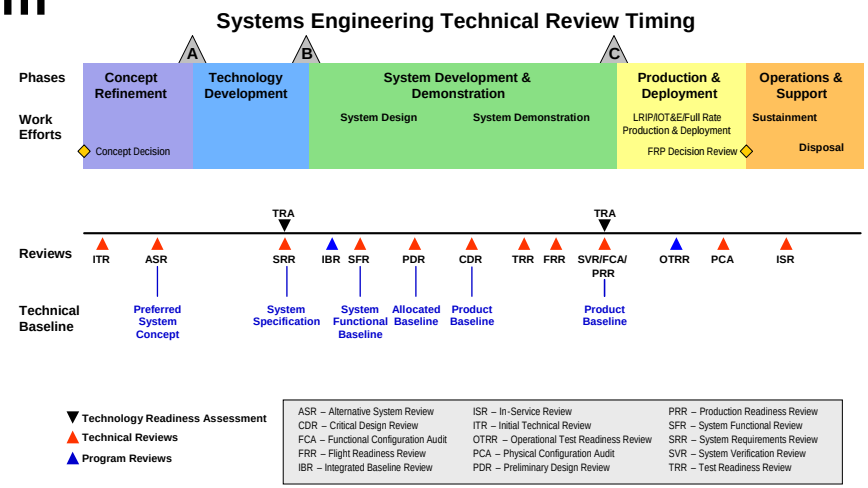
- **SYS 202: Intermediate Systems Planning, Research, Development and Engineering, Part I**
  - **Intermediate-level online course that provides a description of how the SE processes can be applied within the context of the various phases of the Defense acquisition framework.**
  - **Course content includes the scope and role of SE and its key technical inputs and outputs;**
    **the key aspects of technical baselines and the role of technical reviews;**
    **and important design considerations.**

# Education & Training (SYS 203)

## ➢ SYS 203: Intermediate Systems Planning, Research, Development and Engineering, Part II

- **Intermediate-level 1-week long classroom course that requires students to apply the DoD Systems Engineering processes and techniques learned in SYS 101 & SYS 202.**

- **Students work in integrated product teams and apply systems engineering technical processes and technical management processes to a defense system across the various phases of the Defense acquisition framework.**

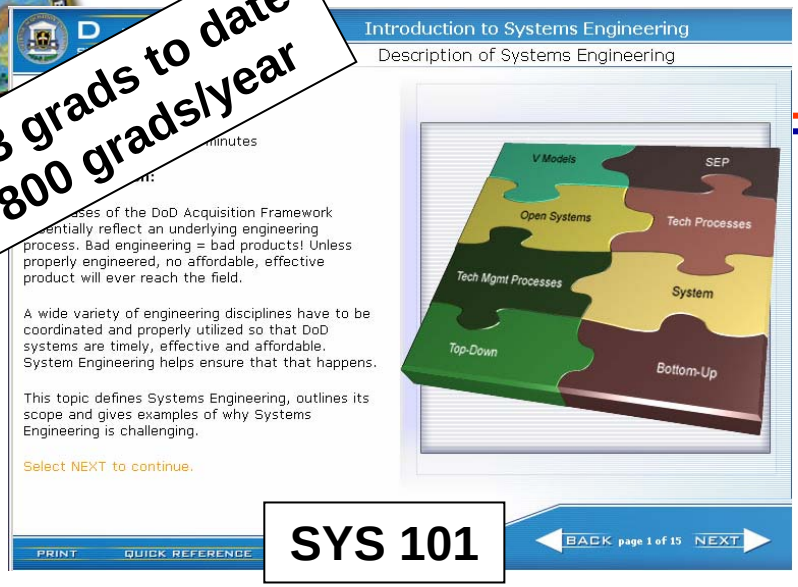


# Education & Training (SYS 302)

## ➢ SYS 302: Technical Leadership in Systems Engineering

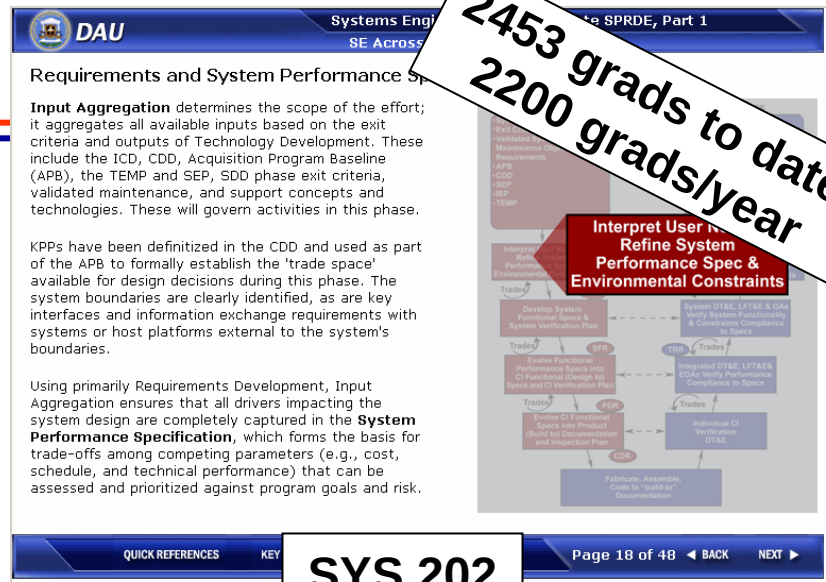
- **Advanced 2-week long classroom course designed for senior DoD acquisition personnel.**
- **Focuses on the application of technical leadership skills within a typical DoD SE IPT environment.**
- **Students take turns leading and participating in an engineering team that analyzes and resolves a variety of technical engineering critical issues.**
- **Class exercises are supplemented by lessons on current policy, architectures, design considerations, ethics, etc.**

7043 grads to date*
7800 grads/year



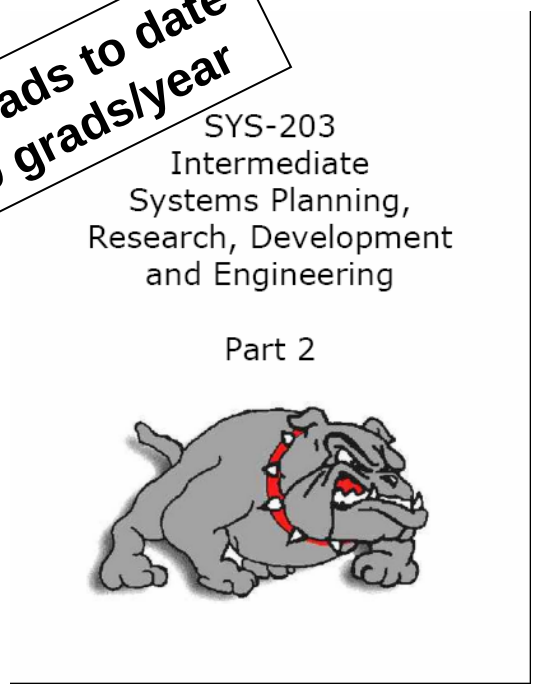

SYS 101

2453 grads to date*
2200 grads/year




SYS 202

1451 grads to date*
2100 grads/year




790 grads to date*
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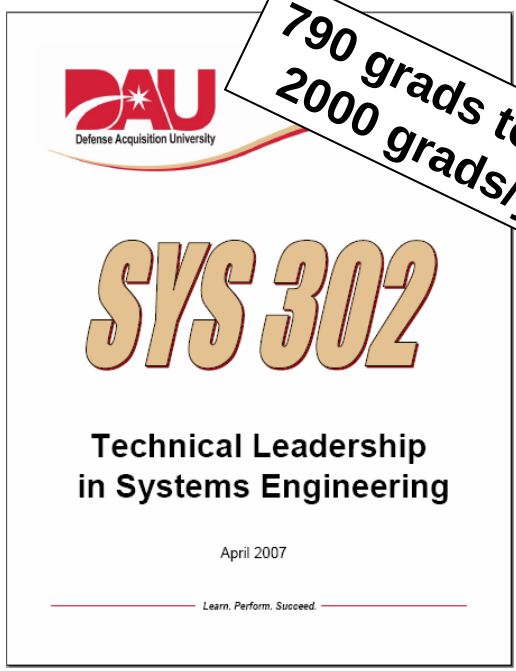



*as of
Sep 10, 2007

# Education & Training (LOG 204)

## ➢LOG 204: Configuration Management

- Fast-paced, cross-disciplinary course that provides the knowledge necessary to apply configuration management (CM)
- Includes the interrelationship of CM to such life cycle activities as systems engineering, data management, logistics support planning, and weapon system sustainment.
- Provides an overview of the concepts and basic practices of CM, including configuration identification, status accounting, audits and verification, configuration change management, performance measures, and CM planning.

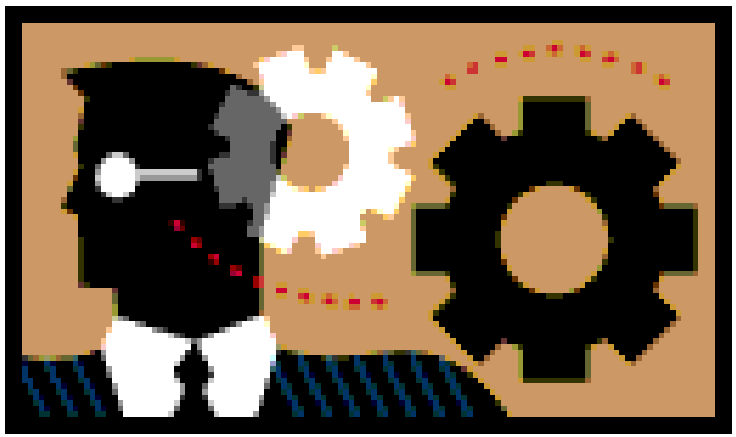
# Education & Training (CLMs)

- **CLE 003: Technical Reviews**
  - Presents essential practical guidelines for integrating several different technical reviews into the systems engineering process and DoD acquisition life cycle based on best engineering practices.

- **CLL 008: Designing for Supportability in DoD Systems**
  - Provides a comprehensive overview and introduction to incorporating the principles of systems engineering throughout the system life cycle to design, develop, produce, and sustain operationally reliable, supportable, and effective systems.

- **CLE 017: Technical Planning (Proposed standard for FY 09)**
  - Presents essential and practical technical planning guidance on how to integrate program management tools, such as earned value management and risk management, with systems engineering tools like requirements management, technical baseline management, and event-based technical reviews into an effective approach for managing programs.

# SPRDE Career Field Update



# SPRDE Career Field Update Background

- **Based on the new SYS curriculum and the FIPT Chair's proposal to enhance certification requirements, the SPRDE/SE FIPT began revising certification standards and Position Category Descriptions.**
- **A proposal was vetted to create an additional career path to provide maximum flexibility in implementing the new standards:**
  - **Original career path would retain the 1, 2, 4 years of experience and similar certification standards.**
  - **Additional career path would encompass 2, 4, and 8 years of experience and enhanced certification standards.**
- **The Acquisition Workforce Senior Steering Board accepted this proposal in August 2006 and the implementation details were worked out and resulted in an agreement in February 2007.**

# Implementation Details

- **New career path, "SPRDE/PSE (Program Systems Engineer)", with a new position code and position category description was established on October 1, 2007.**
- **Targets PEO Chief/Lead Engineer and Program Systems Engineer positions. Requires more years of experience and more training.**
  - ***Components are in the process of recoding positions.***
- **No change to existing career path, "SPRDE/SE (Systems Engineering)".**
  - ***No impact on current SPRDE/SE certification standards.***

# New SPRDE/SE & /PSE Career Paths Certification Standards

## SPRDE-Systems Engineering

### LEVEL I (1 Years)

- ACQ 101
- SYS 101

### LEVEL II (2 Years)

- ACQ 201A
- ACQ 201B
- CLE 003
- SYS 202
- SYS 203

### LEVEL III (4 Years)

- CLL 008
- SYS 302

**Legend:**

- Existing
- New
- Additional

## SPRDE-Program Systems Engineer

### LEVEL I (2 Years)

- ACQ 101
- SYS 101
- Two additional Level 100 courses from a variety of disciplines
- XXX 101
- AND
- XXX 101

### LEVEL II (4 Years)

- ACQ 201A/B
- CLE 003
- SYS 202
- SYS 203
- LOG 204 (CM) + one additional Level 100 or 200 course from a variety of disciplines
- LOG 204
- XXX 101
- OR
- XXX 201

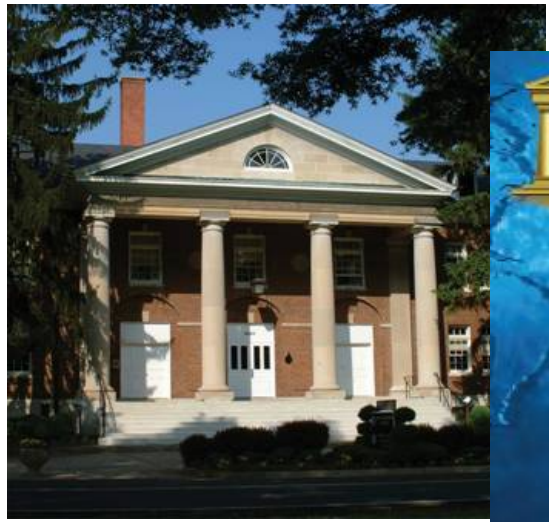
### LEVEL III (8 Years)

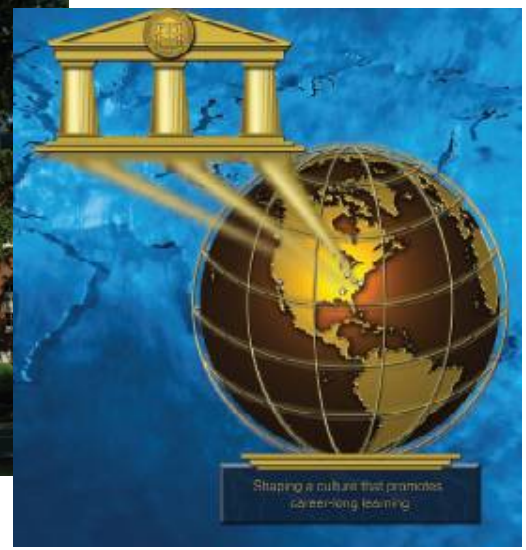
- CLL 008
- SYS 302
- Two additional Level 200 or 300 courses from a variety of disciplines
- XXX 201
- AND
- XXX 301

# Side-by-Side
# DoD SPRDE/PSE vs. INCOSE CSEP

| | DoD SPRDE/PSE | INCOSE CSEP |
|---|---|---|
| Levels | Three levels | Only one level |
| Education | Bachelors or graduate degree in a technical or scientific field such as engineering, physics, chemistry, biology, mathematics, operations research, engineering management, or computer science. | Bachelor's degree/equivalent in technical field (Additional experience must be substituted for non-technical degree)<br>5 more years of engineering for non-technical Bachelor's (total 10 years)<br>10 more years of engineering if no Bachelor's degree (total 15 years) |
| Experience | Level I: 2 years of technical experience from specified career fields<br>Level II: 4 years of technical experience from specified career fields (in acquisition position)<br>Level III: 8 years of technical experience from specified career fields (in acquisition position) | 5 years minimum in multiple SE disciplines |
| Training | Several acquisition, systems engineering, and elective courses from the Defense Acquisition University (DAU), based on level | Only what is needed to pass the exam |
| Recommendations | None | At least 3 Colleagues/Peers/Managers who are knowledgeable in Systems Engineering |
| Examination | None<br>(Exams and assessments contained in individual DAU courses.) | Certification exam, based on current INCOSE SE Handbook. Each exam costs $80. |
| Renewal | None | 3 year renewal<br>120 Professional Development Units required during prior 3 years<br>Renewal Application and Fee is $100 – discounted to $50 for INCOSE member<br>Continuing education log required |
| Certification Cost | None | Application fee is $400 – discounted to $300 for INCOSE members |

# *Core Plus*





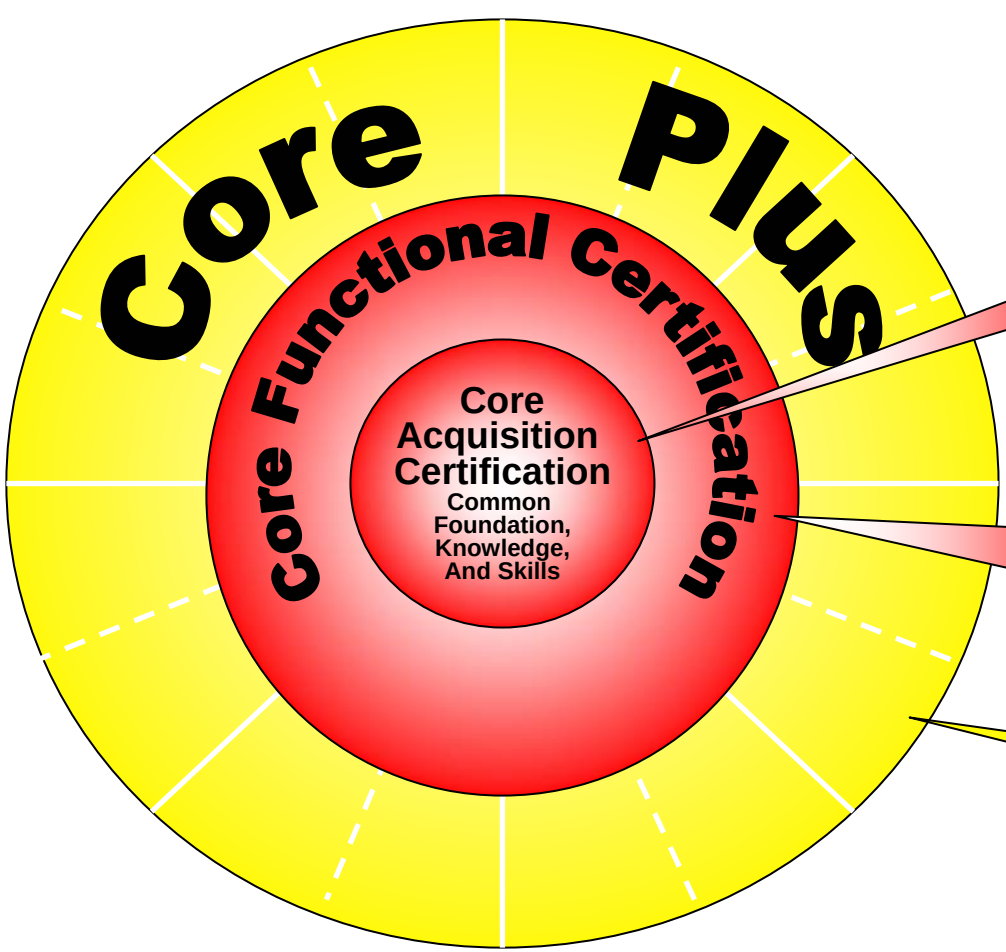

# What is Core Plus?

**Core Plus is an enhancement to the AT&L certification framework.**

**Core Plus is designed to help guide workforce members to additional training beyond that required for certification.**

***Core Plus Video:***
**http://view.dau.mil/dauvideo/view/eventListing.jhtml?eventid=1583**

# Core Plus Target




Common acquisition foundation knowledge and skills

Career Field foundation knowledge and skills

"Plus" or job competency point-of-need training (often CLMs)

# Core Plus Development Guide

## Example for SPRDE-SE Level II

| Core Plus Development Guide [3] | Type of Assignment | | | |
|---|---|---|---|---|
| **Training** [2] | Funct Spec | Software / IT Eng | Dev Eng | S&T Eng / Sci |
| **IRM 201:** *Intermediate Information Systems Acquisition* **CR** | | X | | |
| **LOG 200:** *Intermediate Acquisition Logistics, Part A* | X | | X | |
| **LOG 203:** *Reliability and Maintainability* | X | | X | |
| **PQM 201A:** *Intermediate PQM Part A* | | X | | |
| **SAM 201:** *Intermediate Software Acquisition Management* **CR** | | X | | |
| **STM 201:** *Intermediate S&T Management* **CR** | | | | X |
| **TST 202:** *Intermediate Test and Evaluation* **CR** | X | X | X | X |
| **CLB 016:** *Intro to Earned Value Management* | X | X | | |
| **CLB 017:** *Performance Measurement Baseline* | X | X | | |
| **CLC 041:** *Predictive Analysis and Systems Engineering* | X | X | | |
| **CLE 007:** *Lean 6 Sigma* | X | X | X | |
| **CLE 016:** *Outcome-based Performance Measures* | X | X | | |
| **CLE 017:** *Technical Planning* | X | X | X | X |
| **CLE 020:** *Enterprise Architecture* | X | X | X | X |
| **CLM 101:** *Analysis of Alternatives* | X | X | | X |
| **CLM 029:** *Net-Ready Key Performance Parameter (NR-KPP)* | X | X | X | X |
| **CLM 031:** *Improved Statement of Work* | X | X | X | X |
| **CLM 032:** *Evolutionary Acquisition* | X | X | X | |

| Education |
|---|
| Graduate degree in a discipline such as engineering, physics, chemistry, biology, mathematics, operations research, engineering management, or computer science. |

| Experience |
|---|
| 2 additional years of technical experience. |

# Core Plus Benefits and Challenges

## Benefits:

- **Core Plus advances the AT&L Competency Management Model:**
  - **The right learning – better focus**
  - **The right people – focused on competency needs**
  - **The right time – better connection to job needs**
  - **Keeps the 3-level certification framework**

## Challenges:

- **To make it work, Core Plus requires:**
  - **Increased Supervisor-Employee interaction**
  - **More emphasis on Individual Development Plans**
  - **Senior leadership support**

# The Way Ahead for SE E&T…

- **Keep curriculum up to date and properly aligned with revised policies and guidance.**
- **Establish two-way communications with the SE workforce through outreach and feedback.**
- **Enhance SE Communities of Practice / Websites.**
- **Work with academic institutions and universities on equivalency issues (i.e., AFIT & NPS).**
- **View education and training as both catalyst and facilitator for cultural change.**

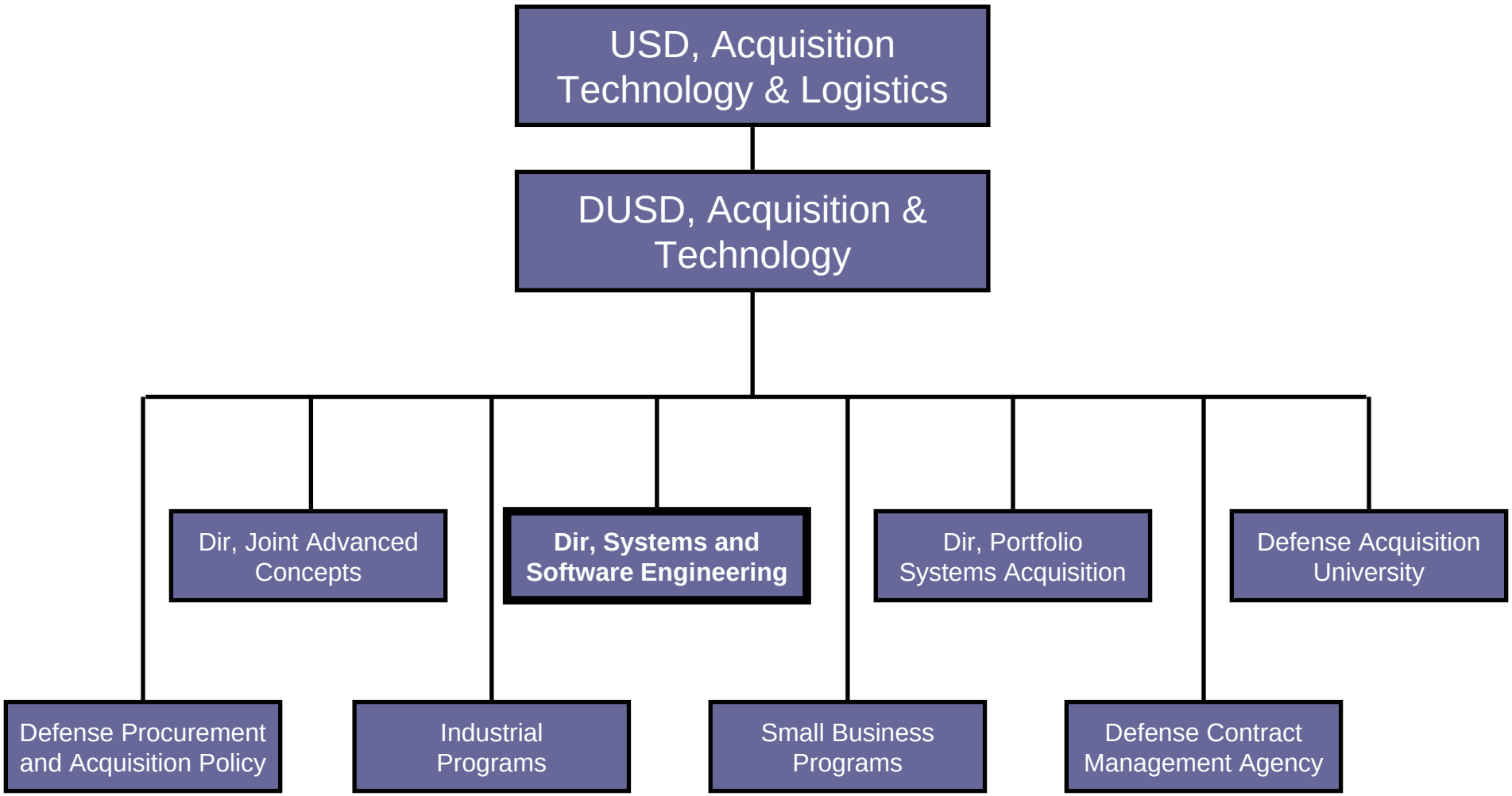
# *Questions?*

# Questions for Discussion

- How do you facilitate Cultural Change?
- How do you get past the “Certification Checklist” mentality?
- How do you assess the SE workforce?
- How do you determine if education and training efforts are achieving desired outcomes?
- How do you keep the SE workforce current?
- What would you put into a 400-level SYS course?

# Backup

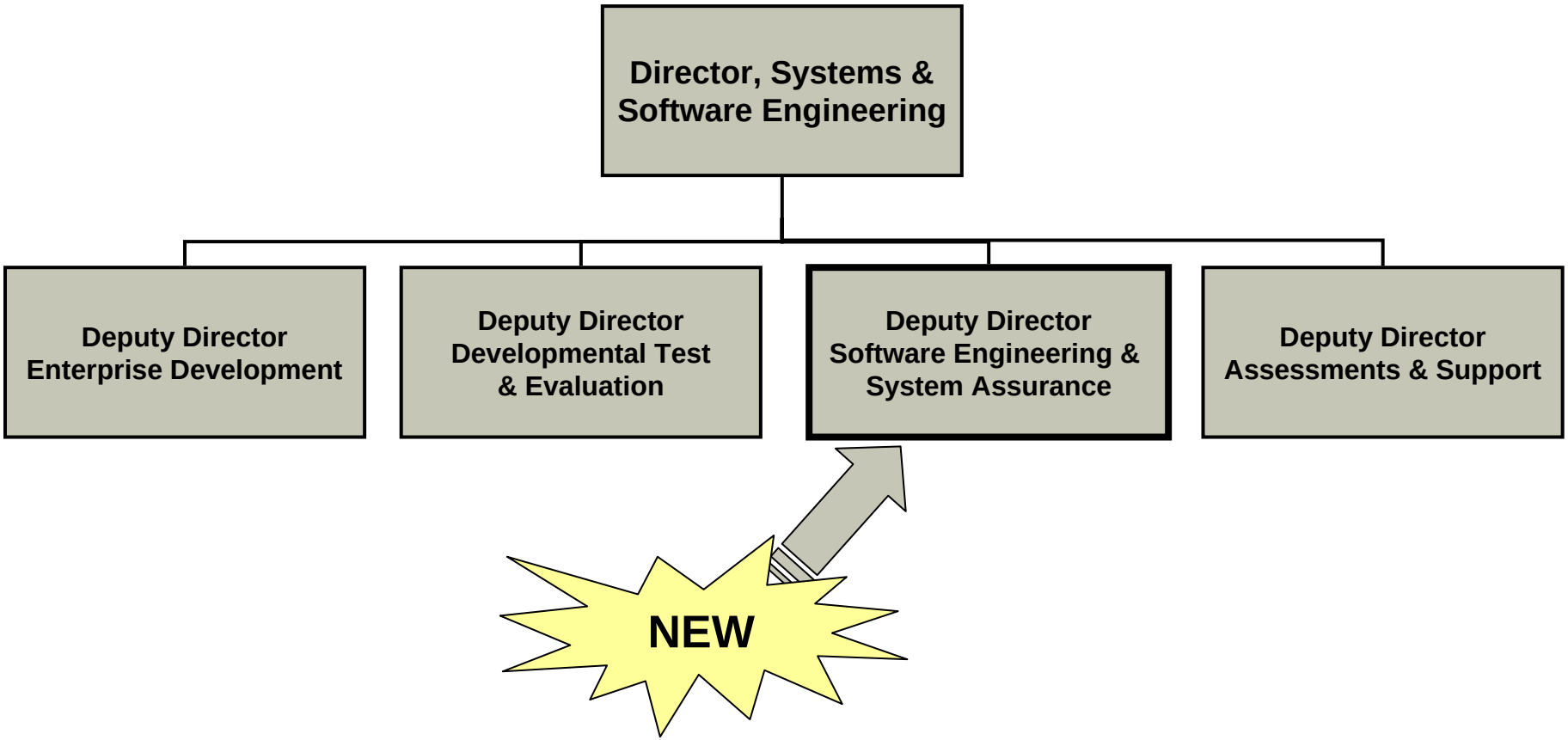
# OUSD (AT&L) Organization




***Flatter, Leaner, Empowered!***

# Systems and Software Engineering

## *An Organizational Construct*




***Management Visibility – Best Practices – Acquisition Excellence***

# What We Have Done To Revitalize Systems Engineering

- Issued DoD-wide SE policy – focused effort on up front, sound technical planning; issued safety policy
- Issued guidance on Systems Engineering, test and evaluation (T&E), software, and safety
- Worked with Defense Acquisition University to revise Systems Engineering curricula -- currently revising T&E and enabling career fields curricula
- Established Systems Engineering Forum—senior-level focus within DoD
- Integrated development testing, software/system assurance, system of systems, and open systems into revitalization efforts
- Instituting a renewed emphasis on modeling and simulation
- Leveraging closer working relationships with industry and academia
- Instituting system-level assessments in support of OSD major acquisition program oversight role

***Much Accomplished – Much to Do!***

# Systems Engineering Plan Trends

- What's working:
  - Programs beginning to establish SE WIPTs early in the life cycle to develop and document their technical planning
  - Increased Program Executive Office level Lead/Chief Systems Engineers involvement in SEP development
  - Movement to event-driven versus schedule-driven programs
    - More focus on entry and exit criteria for technical reviews
- What needs work:
  - Firming up technical planning prior to RFP release
  - Proposed processes for a program not always tailored to fit program
    - Often appear to be copied from a manual or guide.
  - SEP author is someone in program office (contractor or junior person) who is not familiar with the technical strategy.
  - SEPs need to be consistent with key program documents

# What's Next?

- We have revitalized Systems Engineering Policy, Guidance, Education and Training…
- We have driven good systems engineering practices back into the way the acquisition community does business, and have had a positive impact on programs…
- We have expanded the boundaries to include increasingly important enablers for sound SE application…
- We have a rigorous process to capture what went wrong...
- …**but failed to change,** root cause behavior that leads to programs that do not meet cost, schedule, and performance expectations…adequate maturity at program initiation

***Much Accomplished – Much to Do!***