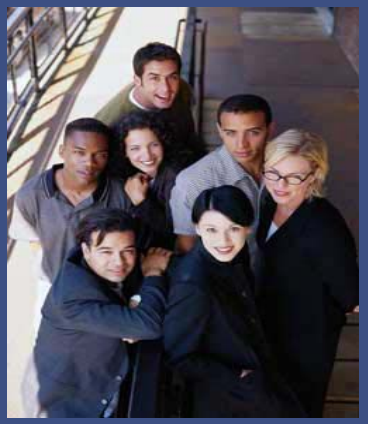
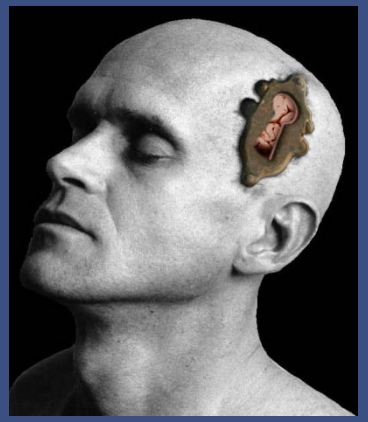




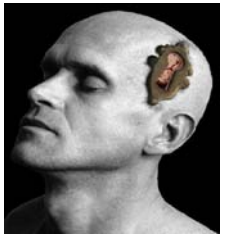
Leveraging CMMI® for Acquisition to Improve Organizational Workforce Performance

Dr. Kenneth E. Nidiffer
Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

November 18, 2009

9th Annual NDIA
CMMI Technology Conference and User Group
Denver, Colorado
November 16-19, 2009

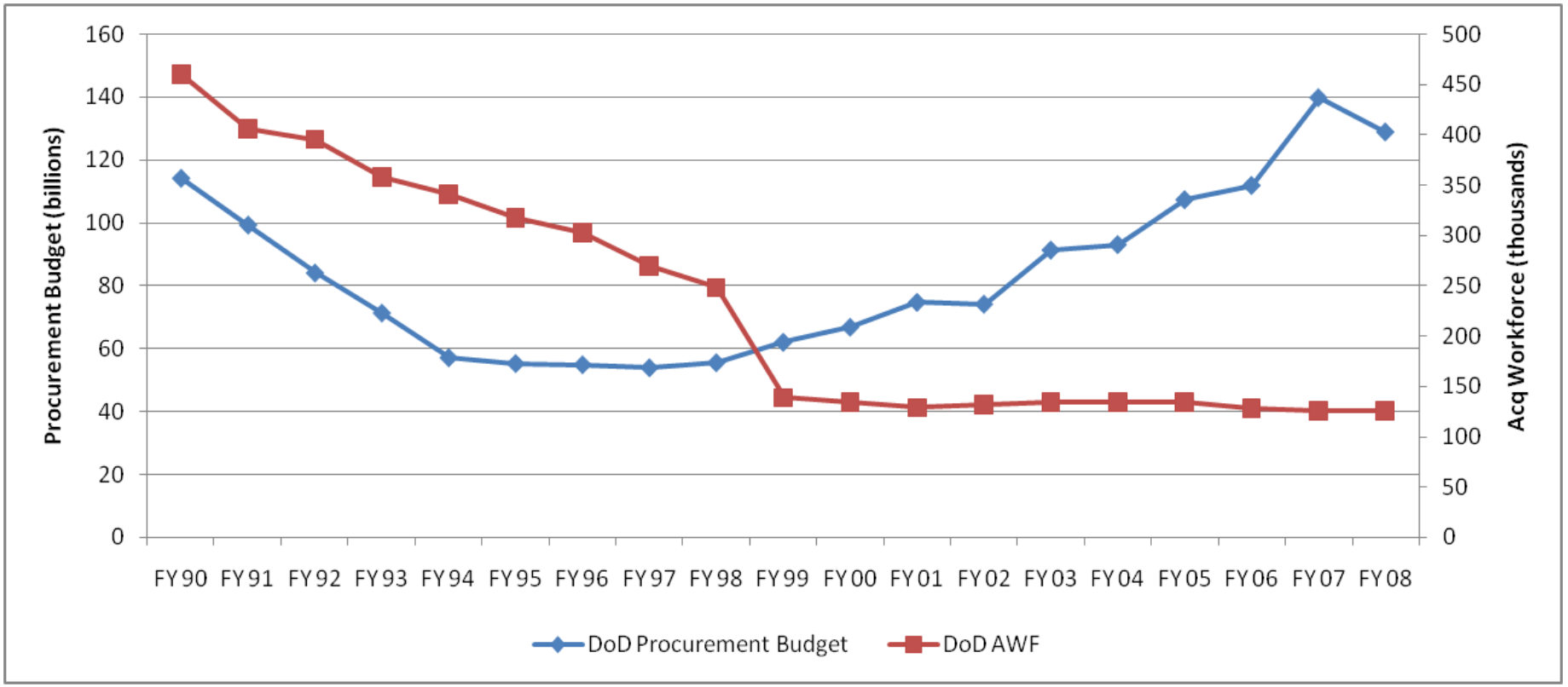
Overview



- Is your organization working towards achieving acquisition excellence?
  - The application of model-driven approach to improve the workforce may be part of the answer!
- What are the rate-limiting variables/drivers that limit success?
- How can the CMMI ® - ACQ model be used?

Achieving Acquisition Excellence via Effective Application of CMMI ® -ACQ

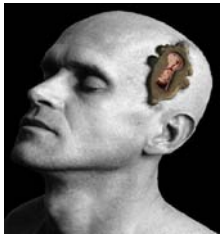
Procurement Budget vs. DoD Acquisition Workforce



Increasing # of Procurements & Complex Systems Coupled With Huge Decrease In Acquisition Workforce

Source: OSD (DDR&E)

Recapture Acquisition Excellence: Revitalize The Acquisition Workforce



Problem

- **Acquisition capability has slowly atrophied**
- **Organic Workforce reductions - 23% since 1999**
  - **Force shaping, reduced training, retirements of critical cost estimators, price analysts, experienced system engineers, contracting officers**

Initiatives

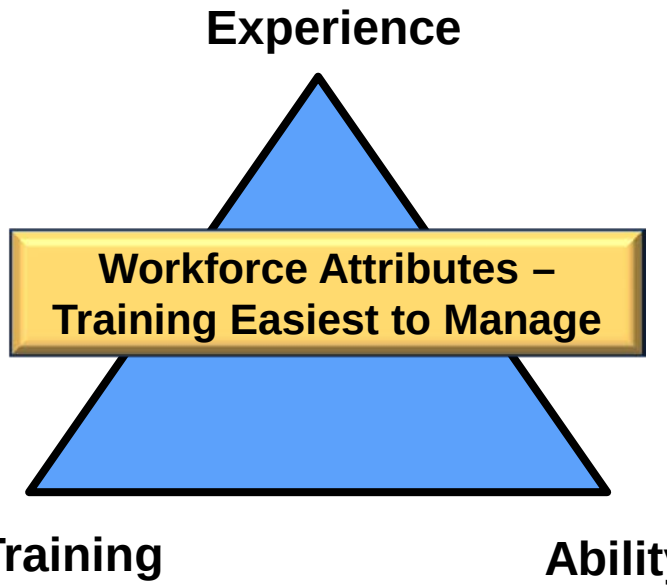
- **Recapitalize the Acquisition Corps/Training**
- **OSD Funding Increased Numbers and Training of Organic Acquisition Personnel**

It Is All About the Acquisition Workforce

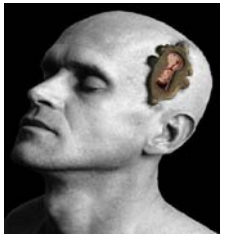
Source: OSD (DDR&E)

Project Purpose

Use a systematic model-driven approach to assess acquisition training and organizational training processes for improving acquisition excellence



Business Motivation



Internal

- Improve organization's performance efficiencies by putting in place trained workforce that can leverage suppliers' capabilities to deliver quality solutions rapidly, at lower costs, and with appropriate technology

External

- President Barack Obama – Mar/May 2009
  "The government will assist agencies in assessing the capacity and ability of the Federal acquisition workforce to develop, manage, and oversee acquisitions" and Weapon Systems Acquisition Reform Act of 2009, Public Law 111-23, 22 May 2009

Drivers for Improving Acquisition Excellence

- External Forces
- Technological
- Human Capital
- Client Unique

Summary of Drivers

External Forces

- Increasing size of untrained defense acquisition workforce
- Retiring of experienced and capable workforce

Technological

- Accelerating technological changes makes systems specific acquisition training difficult at best
- Identifying future competencies to ensure most relevant training content

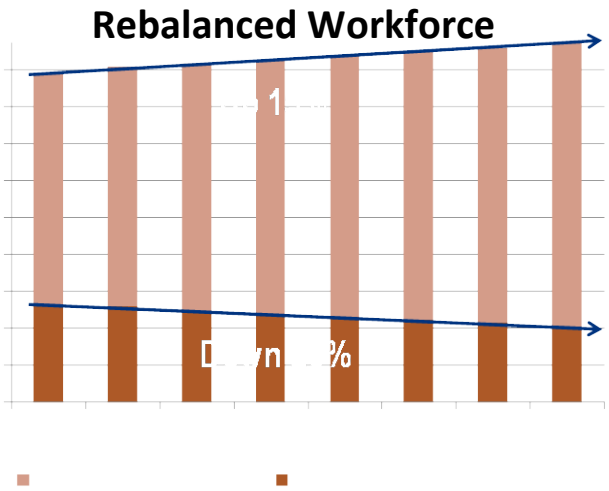
Human Capital

- Changing workforce demographics requiring newer methods of training and management

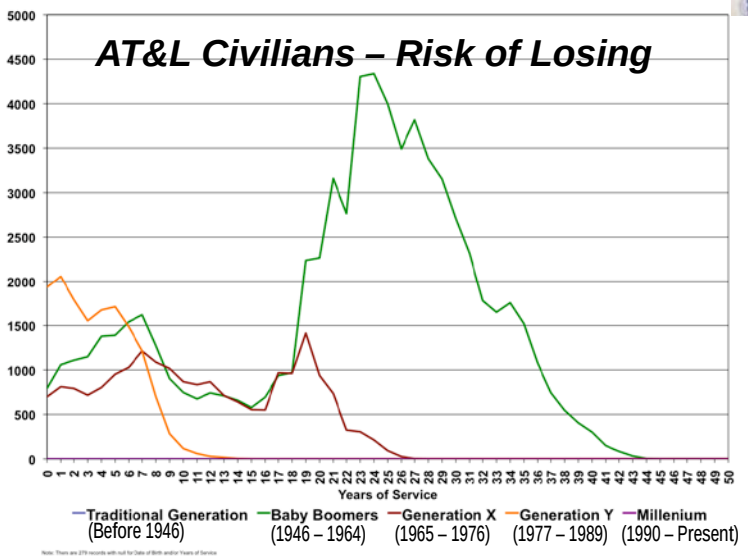
Client Business Environment

- Achieving acquisition excellence in a fiscally constrained environment

External Forces

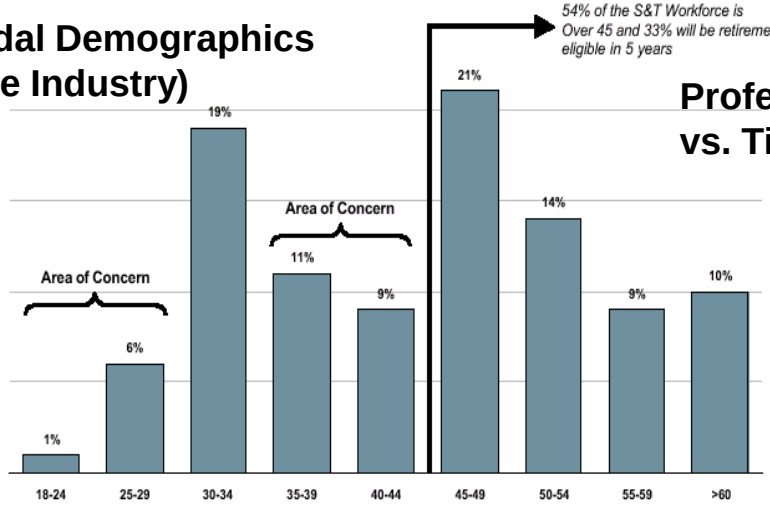


Source: DAU



Source: DAU

Bimodal Demographics (Space Industry)



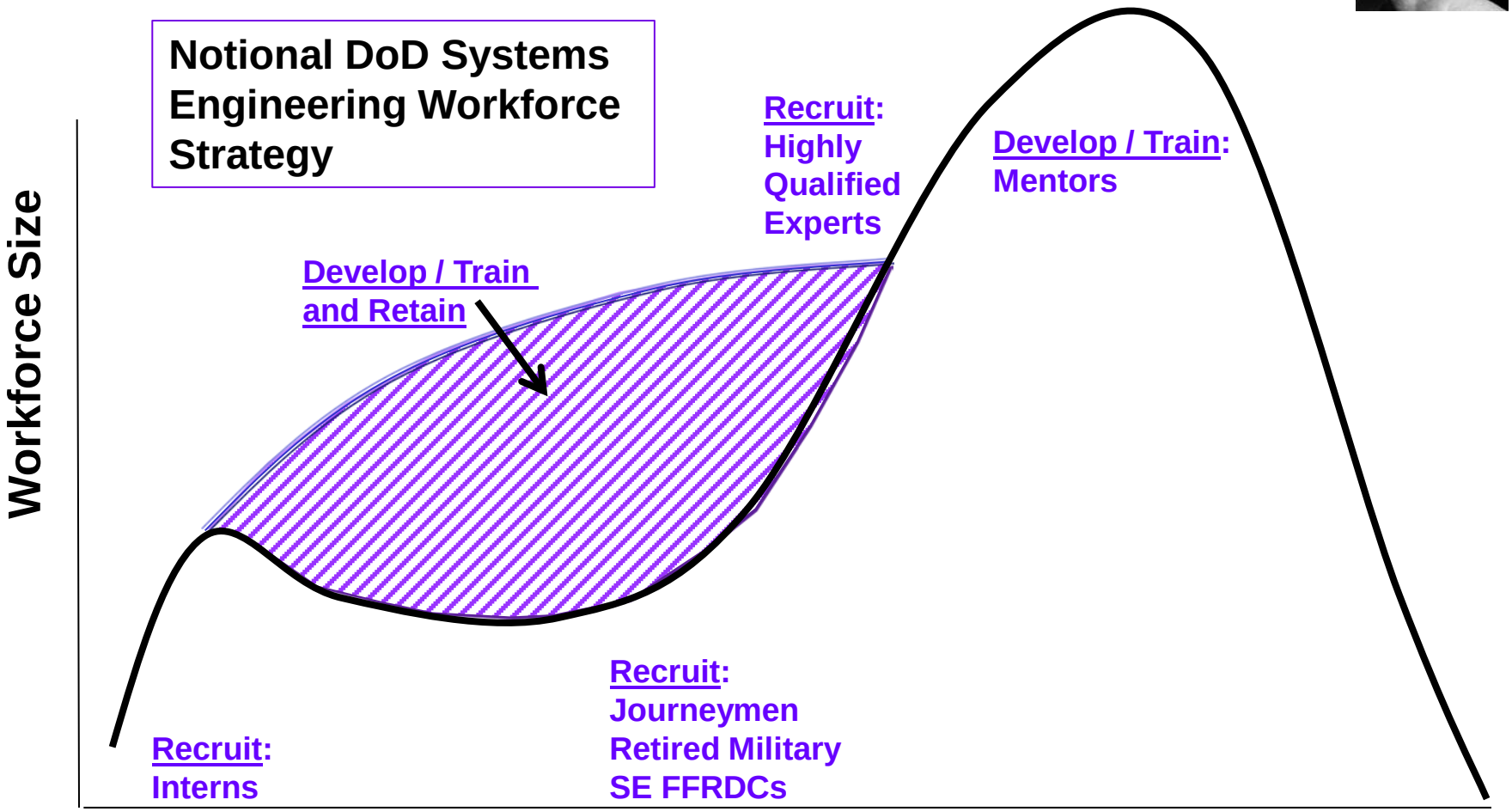
Source: LMSC

Professional Growth vs. Time

Source: DAU

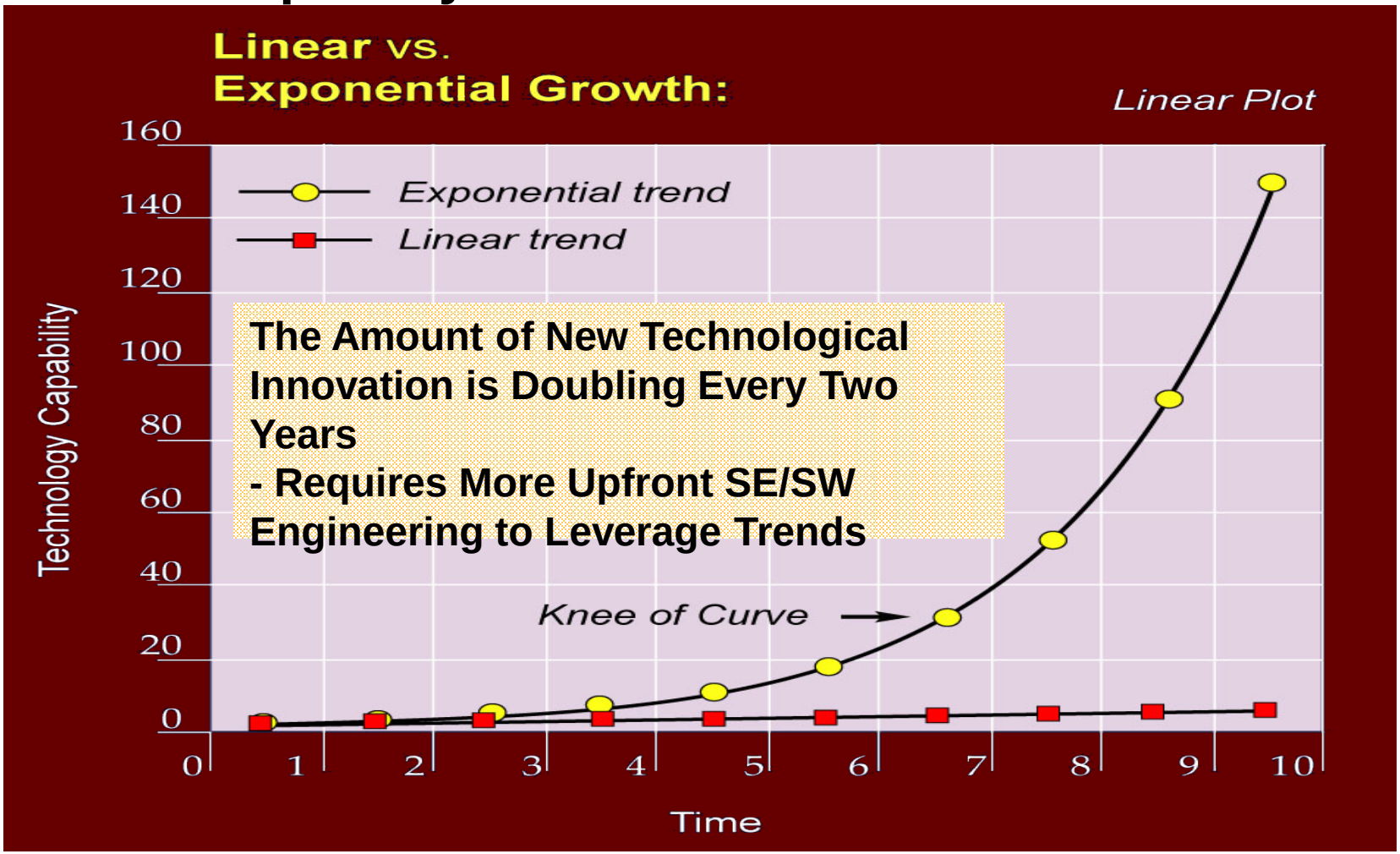
External Forces

Notional DoD Systems Engineering Workforce Strategy

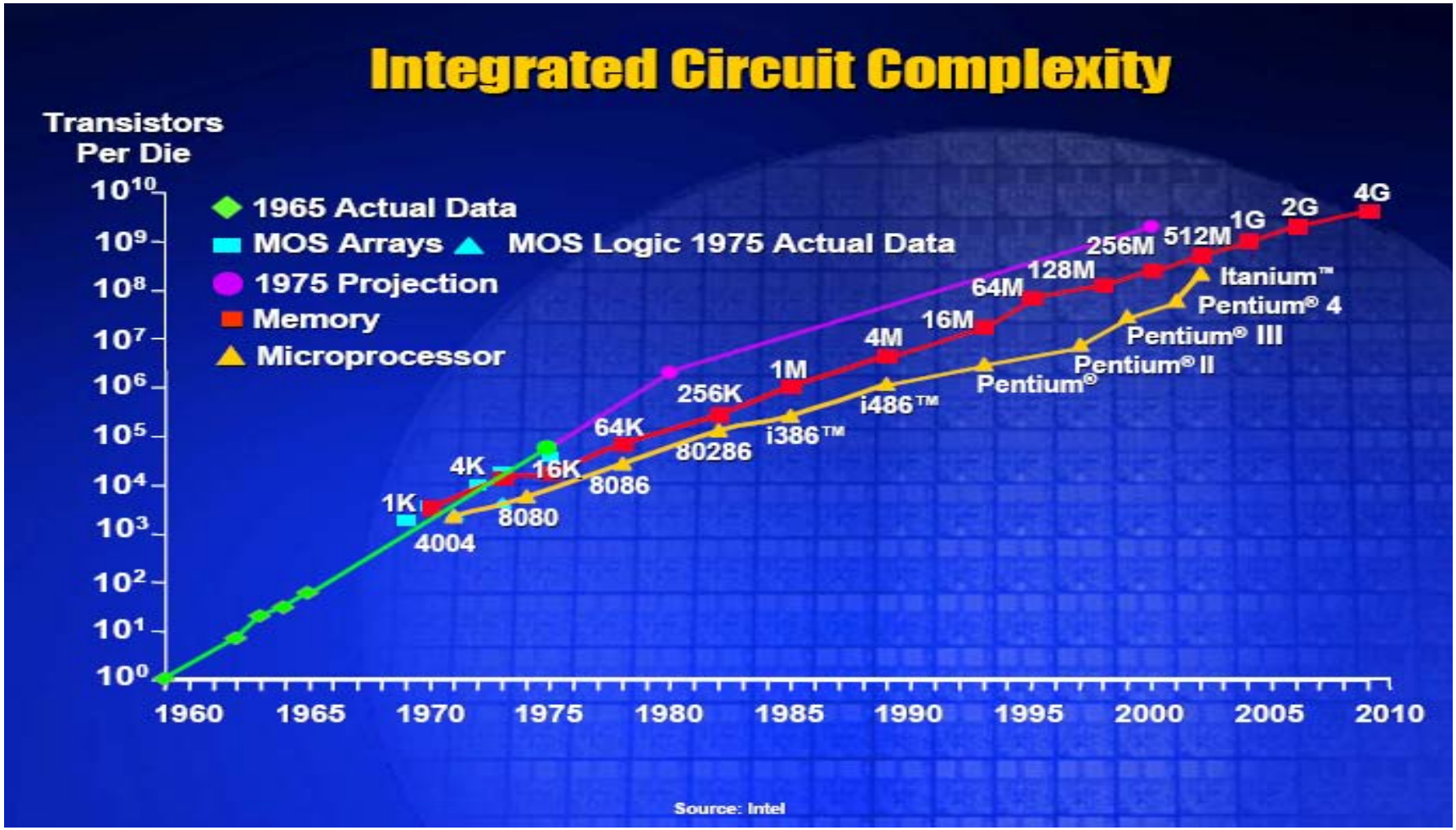


Source: OSD (DDR&E)

Technological: Acceleration of Innovation in the 21st Century - Facilitating Our Ability to Build Move Complex Systems

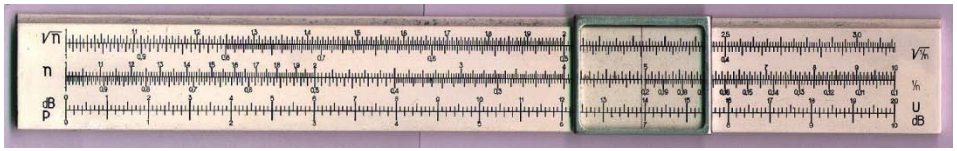


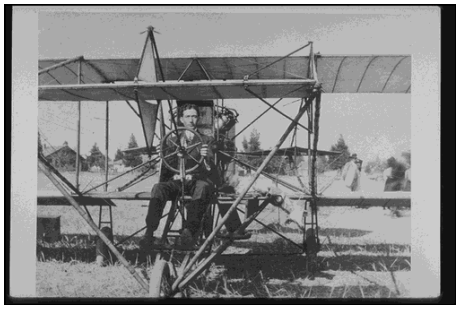
Technological: Moore's Law Holding - The Number of Transistors That Can be Placed on an Integrated Circuit is Doubling Approximately Every Two Years



Technological: Augustine's Law Holding - Growth of Software is an Order of Magnitude Every 10 Years

In The Beginning





1960's

F-4A
1000
LOC

1970's

F-15A
50,000
LOC

1980's

F-16C
300K
LOC

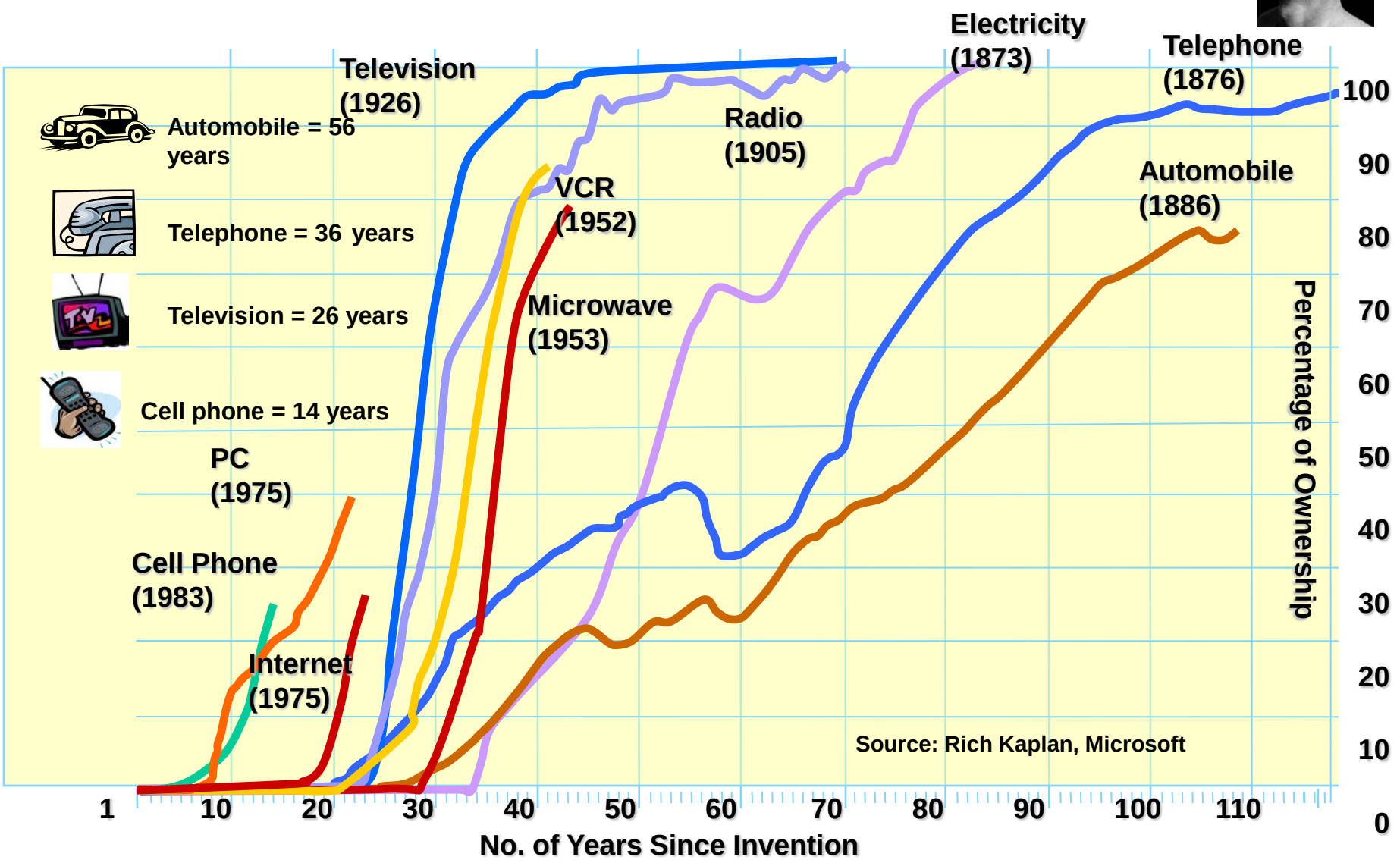
1990's

F-22
1.7M
LOC

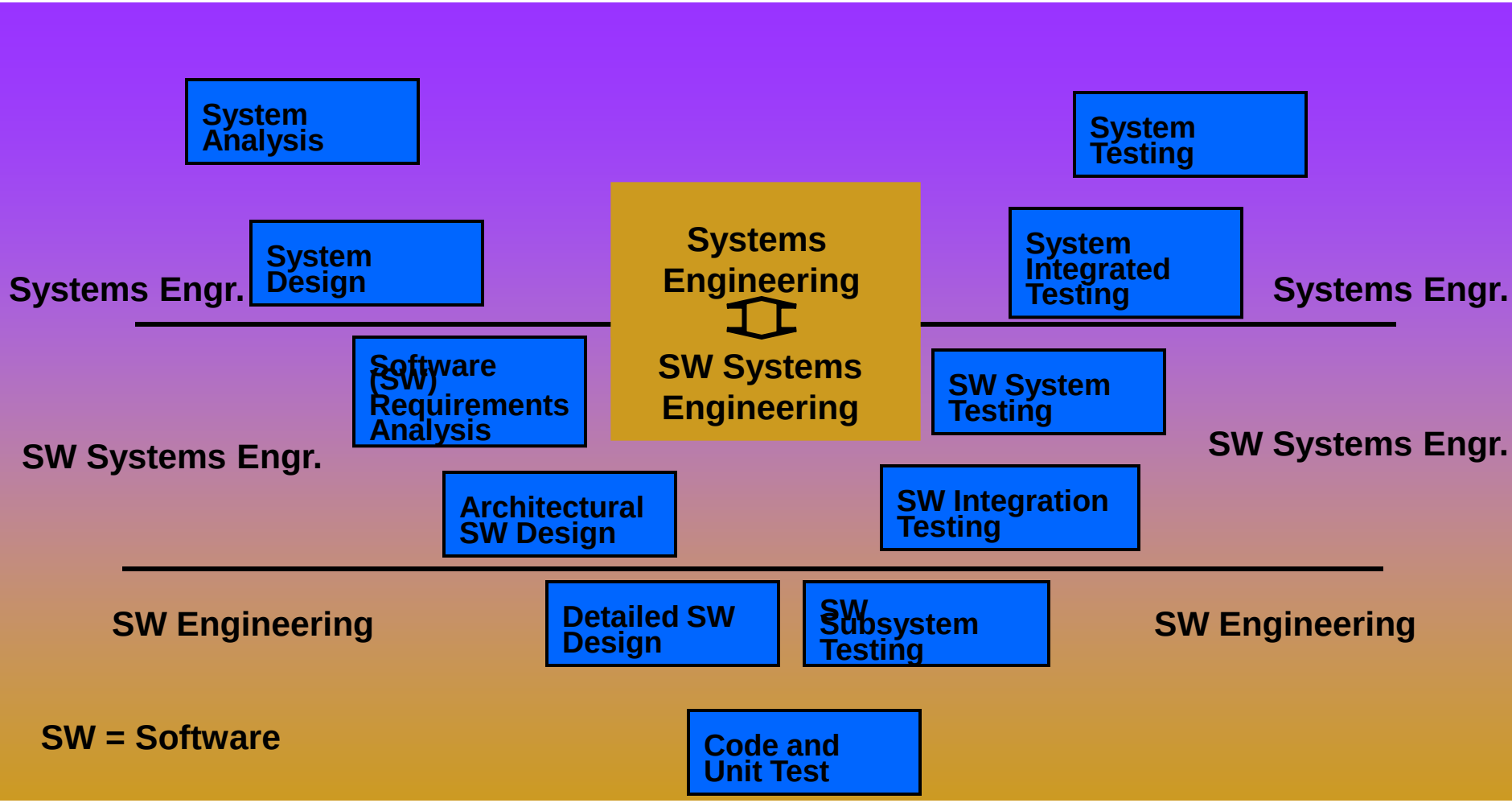
2000+

F-35
>6M
LOC

Technological: Increasing Rate of Adoption



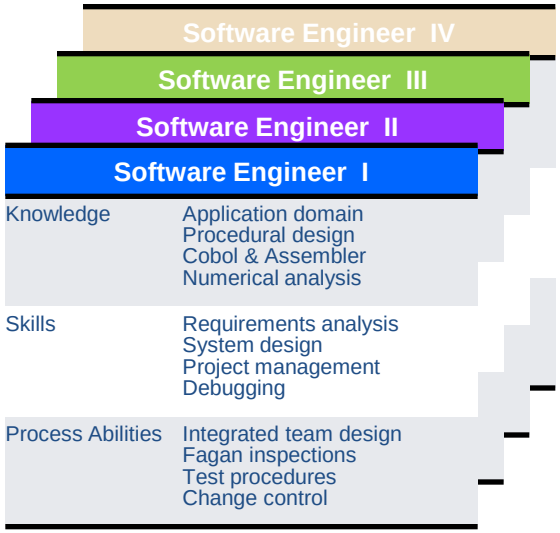
Human Capital: Refocusing University Curriculums - Alignment of Software Systems Engineering



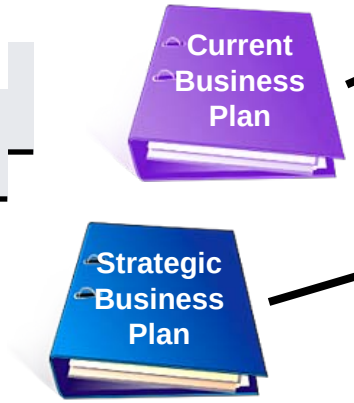
OSD Initiatives: Graduate Software Engineering Reference Curriculum (GSwERC) & Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE)

Human Capital: Using Core Competencies

- Accurate identification of required competencies are important to support the curriculum review and development effort needed to ensure the best and most relevant training.



Competency Family
Software Engineering



Current Resource Profile (initial inventory)

Workforce Competency	Staffing by Capacity Level			
	I	II	III	IV
Software Engineer	17	25	12	5
User Training	2	8	4	1

Current Resource Needs (one-year cycle)

Workforce Competency	Current Staffing Level Needed			
	I	II	III	IV
Software Engineer	23	30	15	7
User Training	4	9	6	2

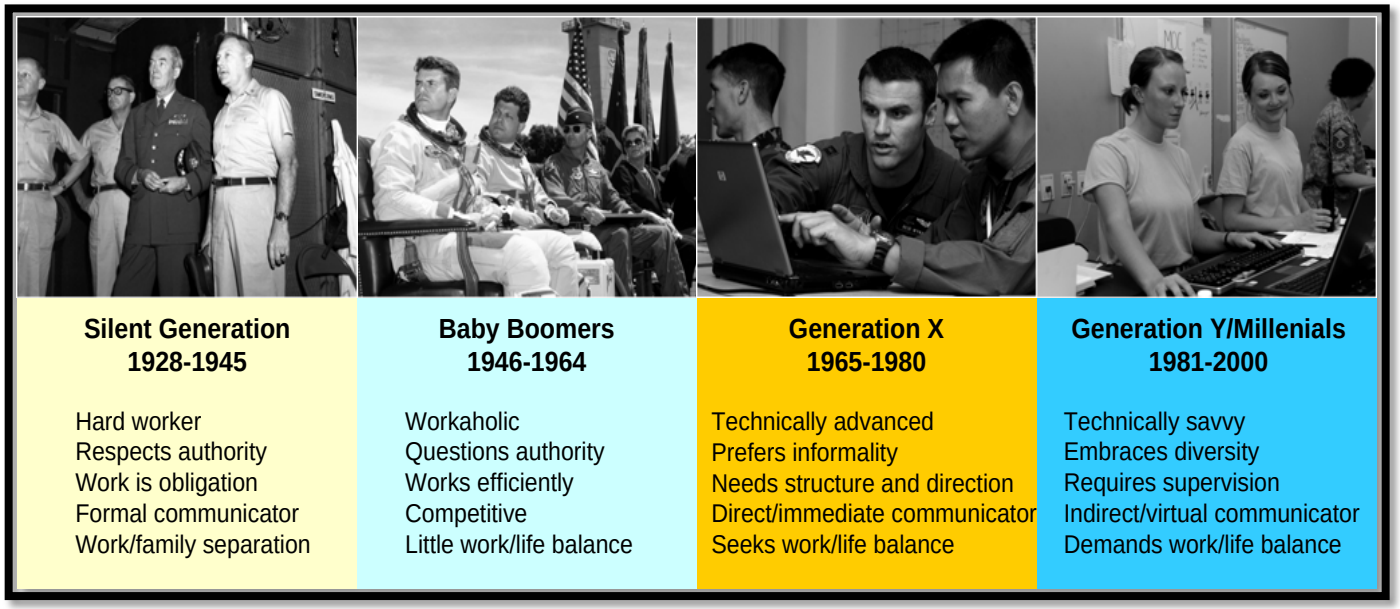
Strategic Workforce Needs (2-5 year)

Workforce Competency	2010Staffing Level Needed			
	I	II	III	IV
Software Engineer	31	35	18	9
User Training	4	10	8	3

Human Capital: Changing Demographics

Demographics of workforce are changing and different views may emerge with four generations to consider

Generation Y professionals entering workforce will likely necessitate non-traditional training techniques, such as virtual approaches

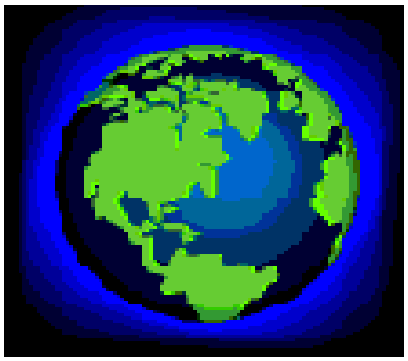


Client Business Environment: Increasingly Complex

Characteristics	Commercial Software Products	Information Technology & Internet Financial Services	Government Aerospace Systems
Market	Commercial	Information technology & internet	Government
Industry	Software	Financial	Aerospace
Packaging	Products	Services	Systems
Primary Output	Software	Integrated system engr & HW & SW & network	Integrated system engr & HW & SW & network
Purpose	User empowerment: effectiveness, efficiency, creativity	Organization/business operations	Mission/science capabilities
Project Duration	1-36 months	1-18 months	6 months - 10 years
Team Size	1-1000's	1-1000's	10's-1000's
Ratio of Custom to COTS/Reuse	Software: Low-high	Business logic: High Others: Low	All: High
Agreement	License	Service level agreement	Contract
Customer	External	Internal and external	External
# Customers	100's-1,000,000's	1-1,000,000's	1
Focus	Features, Time-to-market, Ship it	User experience, Workflow cycletime, Uptime	Reliability, Milestones, Interdependencies

Source – Northrop Grumman

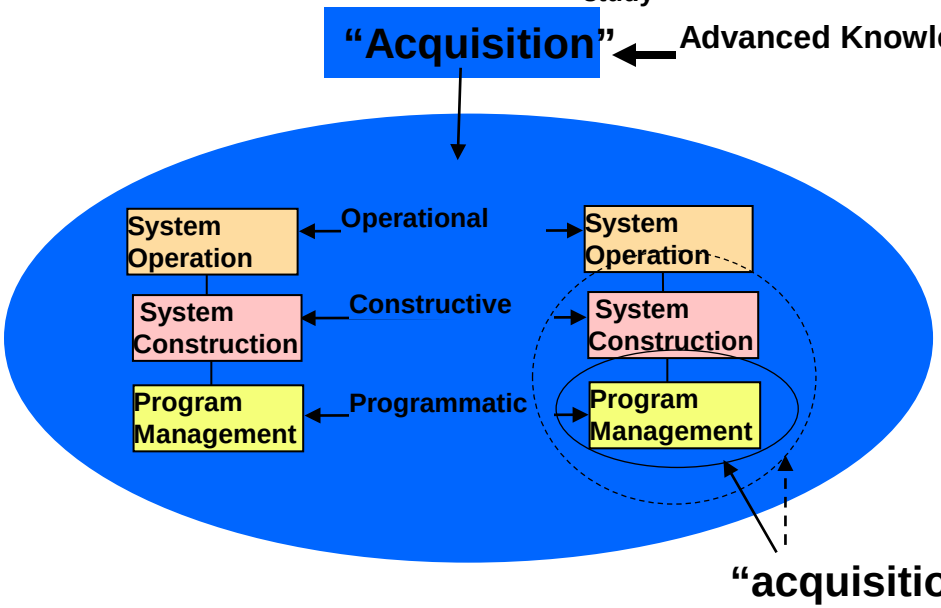
Client Business Environment: Acquisition Shifts

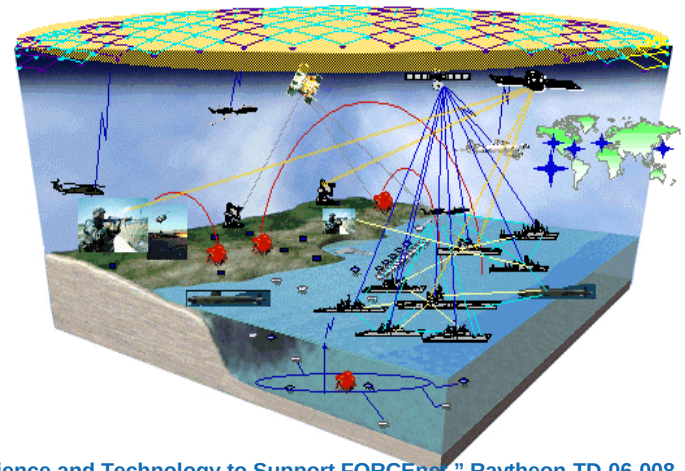


2005 study confirmed*:

- In advanced knowledge-based organizations, management's desire for the flow of knowledge is greater than the desire to control boundaries
- Unlike the matrix organization, there is less impact on the dynamics of formal power and control

*** Using Communities of Practice to Drive Organizational Performance and Innovation, 2005, APQ study**





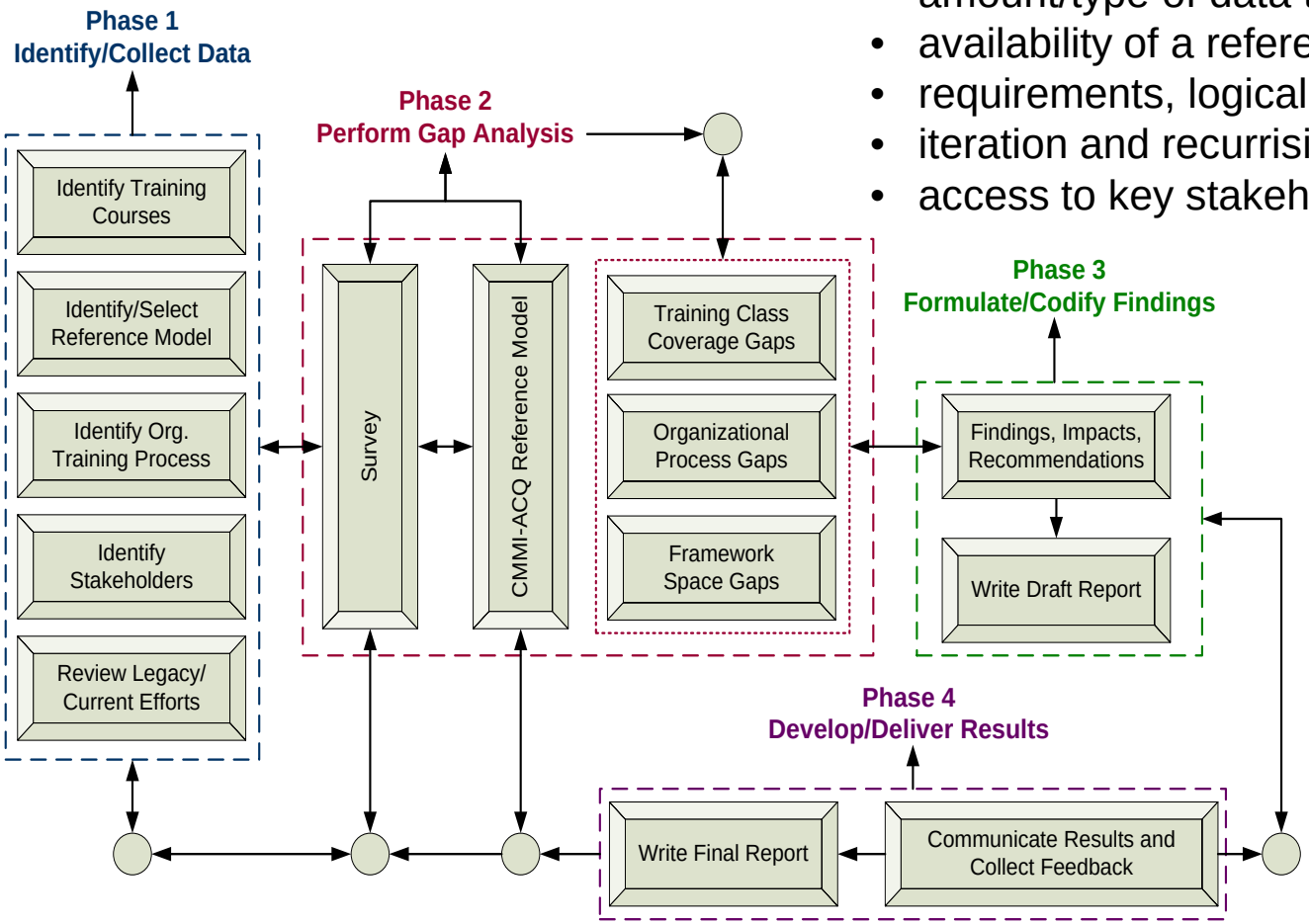
From "Science and Technology to Support FORCEnet," Raytheon TD-06-008. Used by permission.

Ref: Jim Smith, **(703) 908-8221,jds@sei.cmu.edu**

Systems Engineering Approach

Selected based on

- amount/type of data to be reviewed
- availability of a reference model
- requirements, logical and physical loops
- iteration and recurrision activities
- access to key stakeholders



Source: SEI

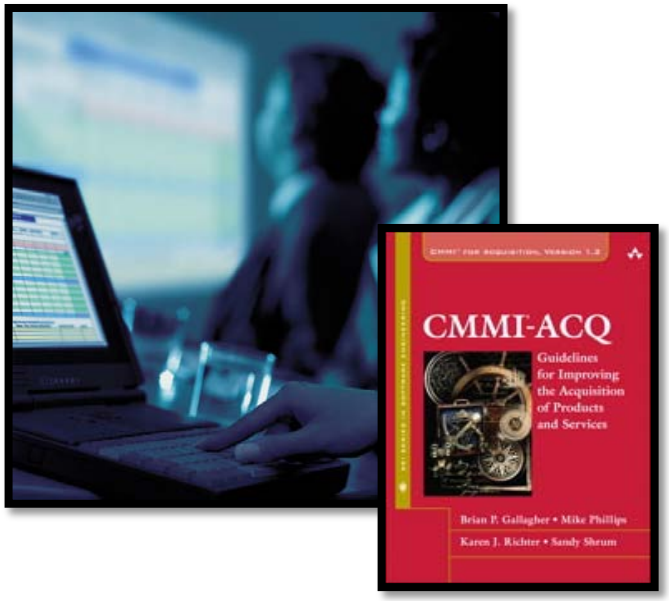
Project Objectives

During assessment Phase 1 project objectives were formulated in terms of five questions

- Do coverage gaps exist in the training of acquisition best practices?
- Do gaps exist in acquisition training on the unique aspects of the client's system acquisitions?
- Do gaps exist in the training of the client's acquisition lifecycle framework and processes?
- Do best-practice gaps exist in the client's organizational training processes?
- Do gaps exist in identifying training requirements for satisfying the acquisition workforce core competencies?

Reference Model

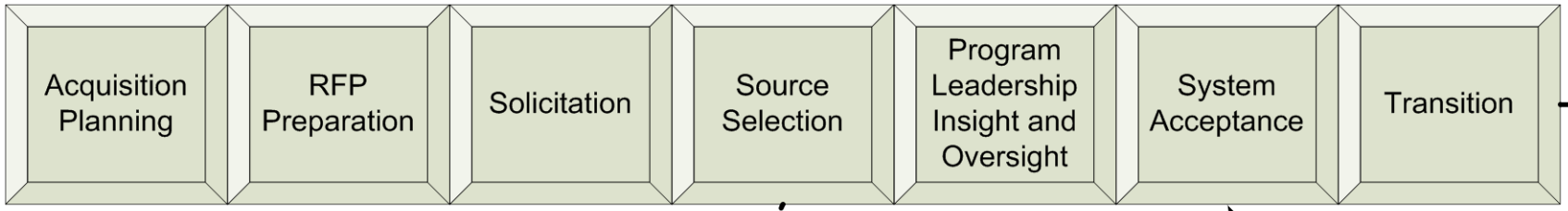
Evaluated client's acquisition training program components using Capability Maturity Model Integration® for Acquisition (CMMI® -ACQ) as reference model

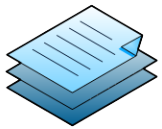


Assessment Framework: *CMMI®-ACQ*

Operational Need

Focus on Acquisition Best Practices
(Acquirer)





Operational Capabilities

Development
(Developer)

Source: SEI

CMMI® -ACQ categories and process areas

Category	Process Area
Acquisition	**Agreement Management (AM)** **Acquisition Requirements Development (ARD)** **Acquisition Technical Management (ATM)** **Acquisition Validation (AVAL)** **Acquisition Verification (AVER)** **Solicitation and Supplier Agreement Development (SSAD)**
Process Management	Organizational Innovation and Deployment (OID) **Organizational Process Definition (OPD)** Organizational Process Focus (OPF) Organizational Process Performance (OPP) **Organizational Training (OT)**
Project Management	**Integrated Project Management (IPM)** **Project Monitoring and Control (PMC)** **Project Planning (PP)** Quantitative Project Management (QPM) Requirements Management (REQM) Risk Management (RSKM)
Support	Causal Analysis and Resolution (CAR) Configuration Management (CM) Decision Analysis and Resolution (DAR) Measurement and Analysis (MA) Process and Product Quality Assurance (PPQA)

CMMI® -ACQ model was developed to codify best practices to help organizations improve acquisition processes

CMMI® reference models have gained significant traction across commercial and defense community and are widely used throughout world [CMMI Product Team 07]

Source: SEI

Summary of Results

- Strengths
- Areas for Improvement
- Lessons Learned

Results – General Overall Strengths

- Excellent coverage in the training of acquisition best practices
- Adequate number and variety of course offerings
- Simple but adequate training facilities
- Consistency of course material & presentation layout & style
- Variety of media used for announcing upcoming courses
- Scope and breath of Earned Value programs
- Knowledgeable SME* teach classes
- Talented instructor workforce
- Intelligent student population
- Professionalism of the training staff
- Desire to improve

Results

Findings	25
Impacts	20
Recommendations	23
Considerations/ Potential Solutions - ways to address some of the recommendations	40

Systematic Improvement in Client's Organizational Training Processes Needed

Representative Results: *Question 1*

Question 1: Do Coverage Gaps Exist in the Training of Acquisition Best Practices?

Findings

- **Detailed findings awaiting client approval**

Impacts

- Missing opportunities to
  - ~ attract more students
  - ~ provide training on the most relevant issues
  - ~ effectively plan
  - ~ save resources
  - ~ provide a richer variety of courses
  - ~ continuously improve training processes

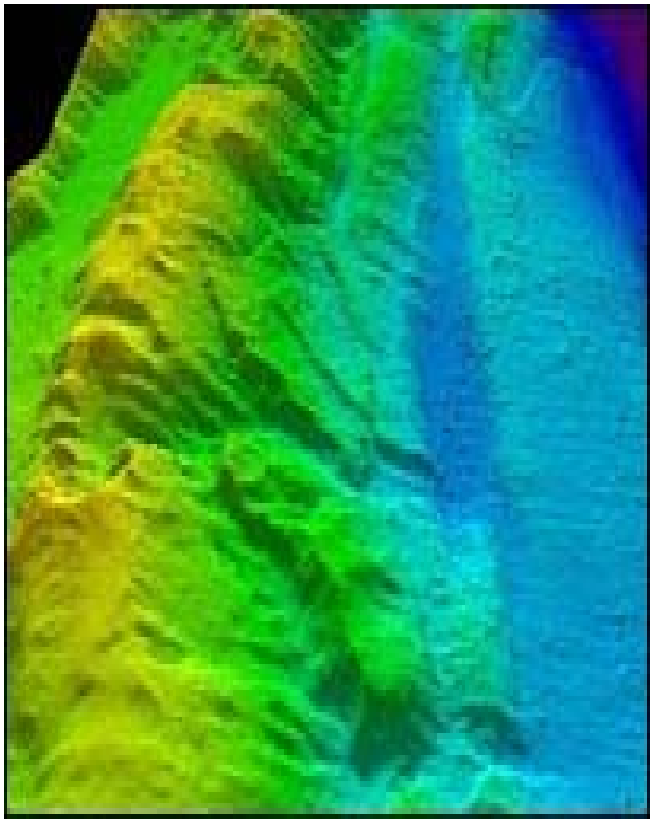
Recommendations and Considerations

- Conducting a review to assess use of web-based and non-traditional acquisition training
  Consider: Leveraging of efforts by DAU, commercial industry and academia
- Conducting a review of best practices for training among different types of acquisitions
  Consider: Developing and teaching approaches that focus on agile and SOA acquisition approaches
- Making a better use of repository information
  Consider: *Using* DAU's Acquisition Best Practices
- Putting a systematic process improvement program in place
  Consider: Using CMMI-ACQ and IDEAL
- Developing a strategic plan
  Consider: Socializing plan among relevant stakeholders

Lessons Learned

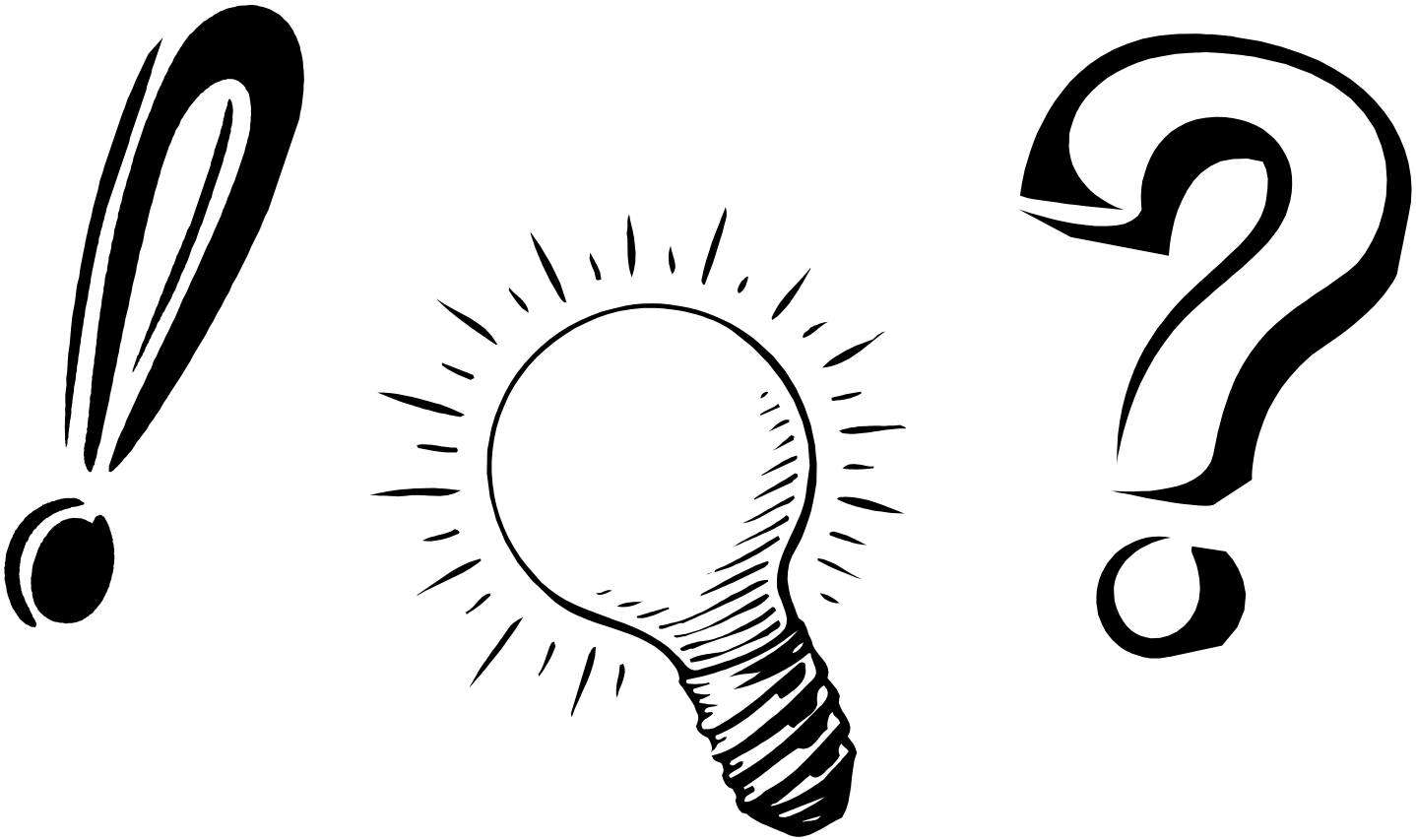
Tsunami

- Tsunami-like impacts on new acquisition training requirements
  - Rapid, large-scale disturbance of current training needs envisioned
  - Forces will include technological, human capital, external and government needs
- Training departments have incorporated best acquisition practices into their training courses; however
  - Mapping of core competencies to training courses needs to be done
  - Training architectures needed
- Developers of organizational training processes could benefit from the application of systems engineering



Images of the Ocean Floor

Wrap Up



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