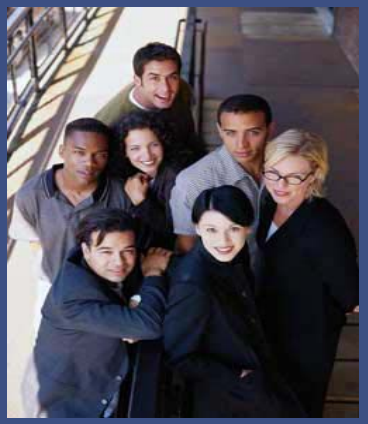
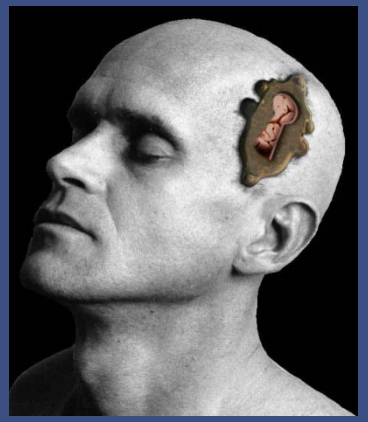




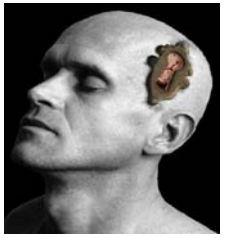
Achieving Acquisition Excellence via Improving the Systems-Engineering Workforce

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

October 29, 2009

12th Annual NDIA
Systems Engineering Conference
"Achieving Acquisition Excellence via Effective Systems Engineering"
San Diego, CA
26-29 October

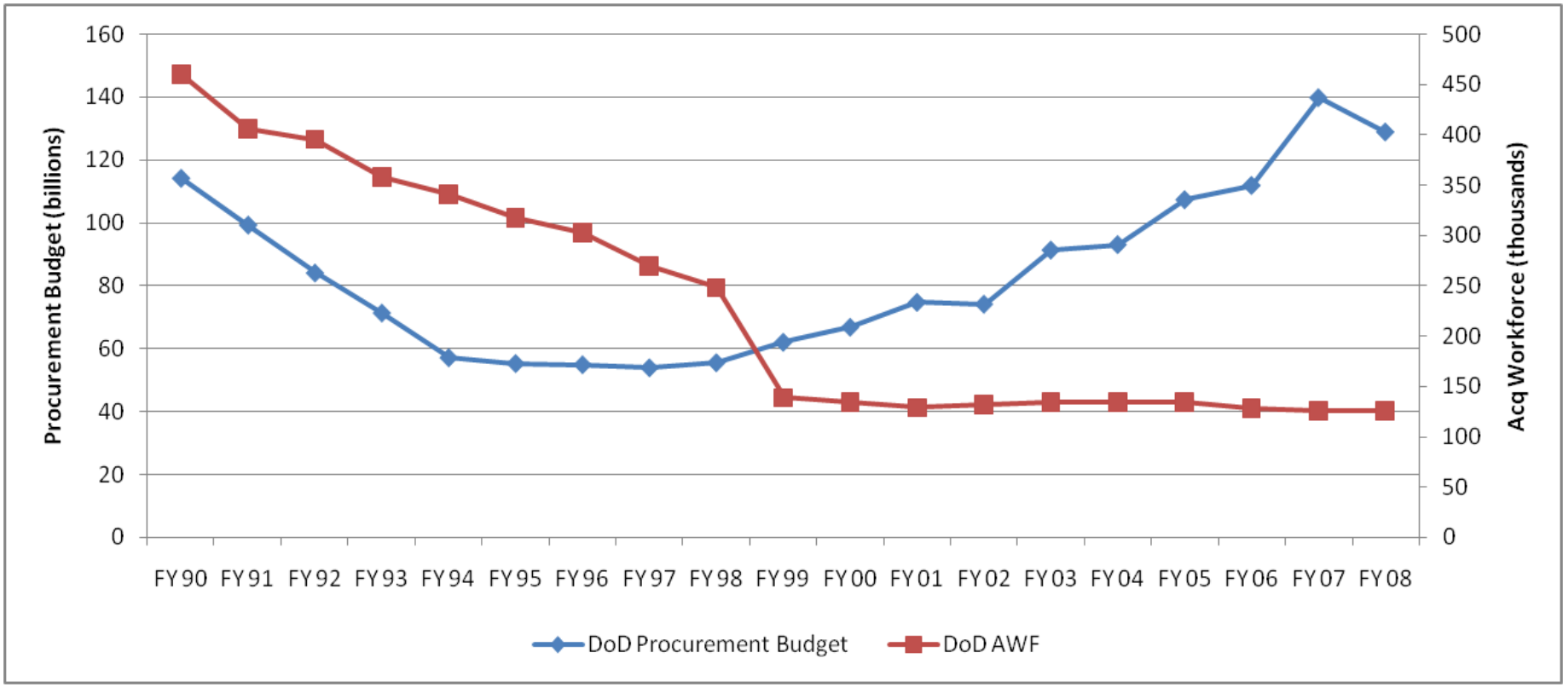
Overview



- Is your organization working towards achieving acquisition excellence?
  - The application of systems-engineering 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?

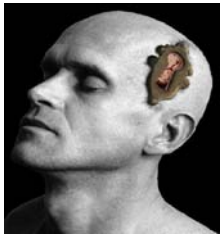
Achieving Acquisition Excellence via Effective Application of CMMI ® -ACQ

Procurement Budget vs. DoD Acquisition Workforce



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

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**

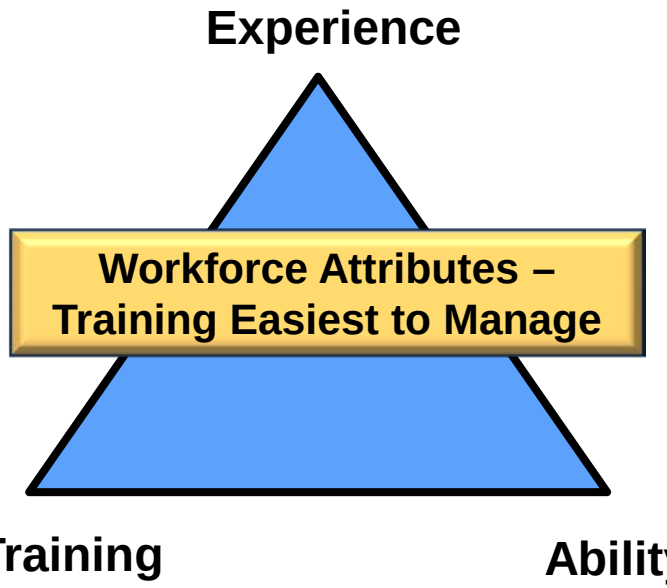
Initiatives

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

It Is All About the Acquisition Workforce

Project Purpose

Use a systems engineering approach to assess acquisition training and organizational training processes for improving acquisition excellence



Summary of Systems Engineering 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

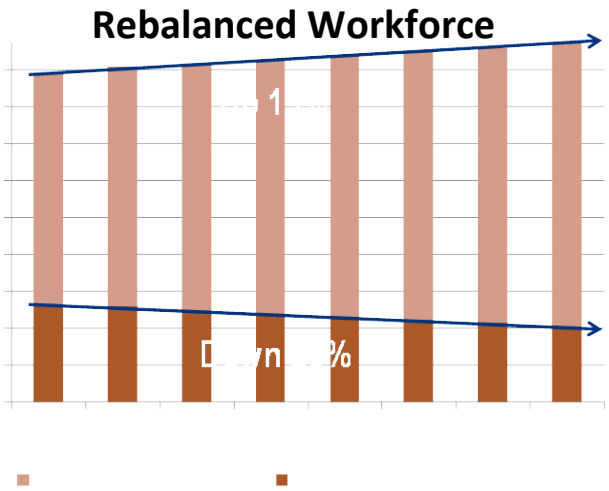
Human Capital

- Changing workforce demographics requiring newer methods of training and management

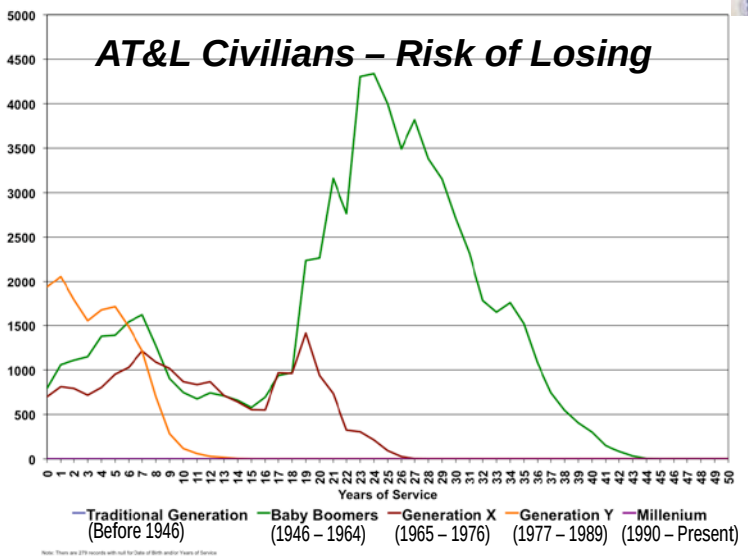
Client Business Environment

- Achieving acquisition excellence in a fiscally constrained environment

External Forces

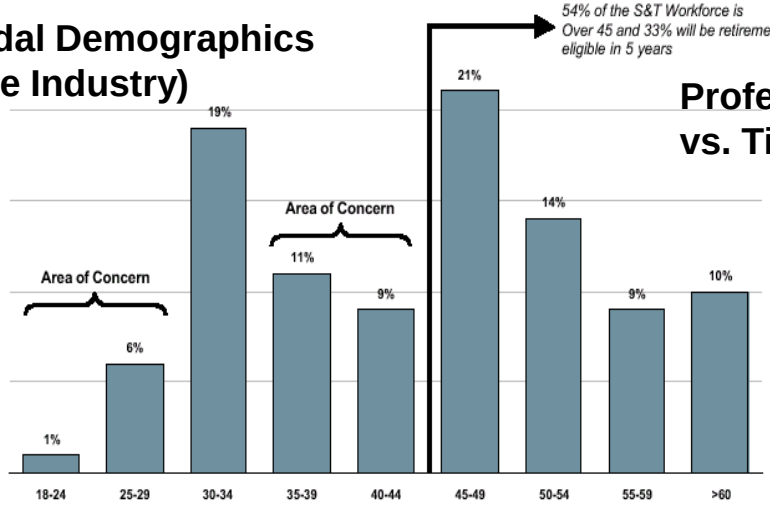


Source: DAU



Source: DAU

Bimodal Demographics (Space Industry)

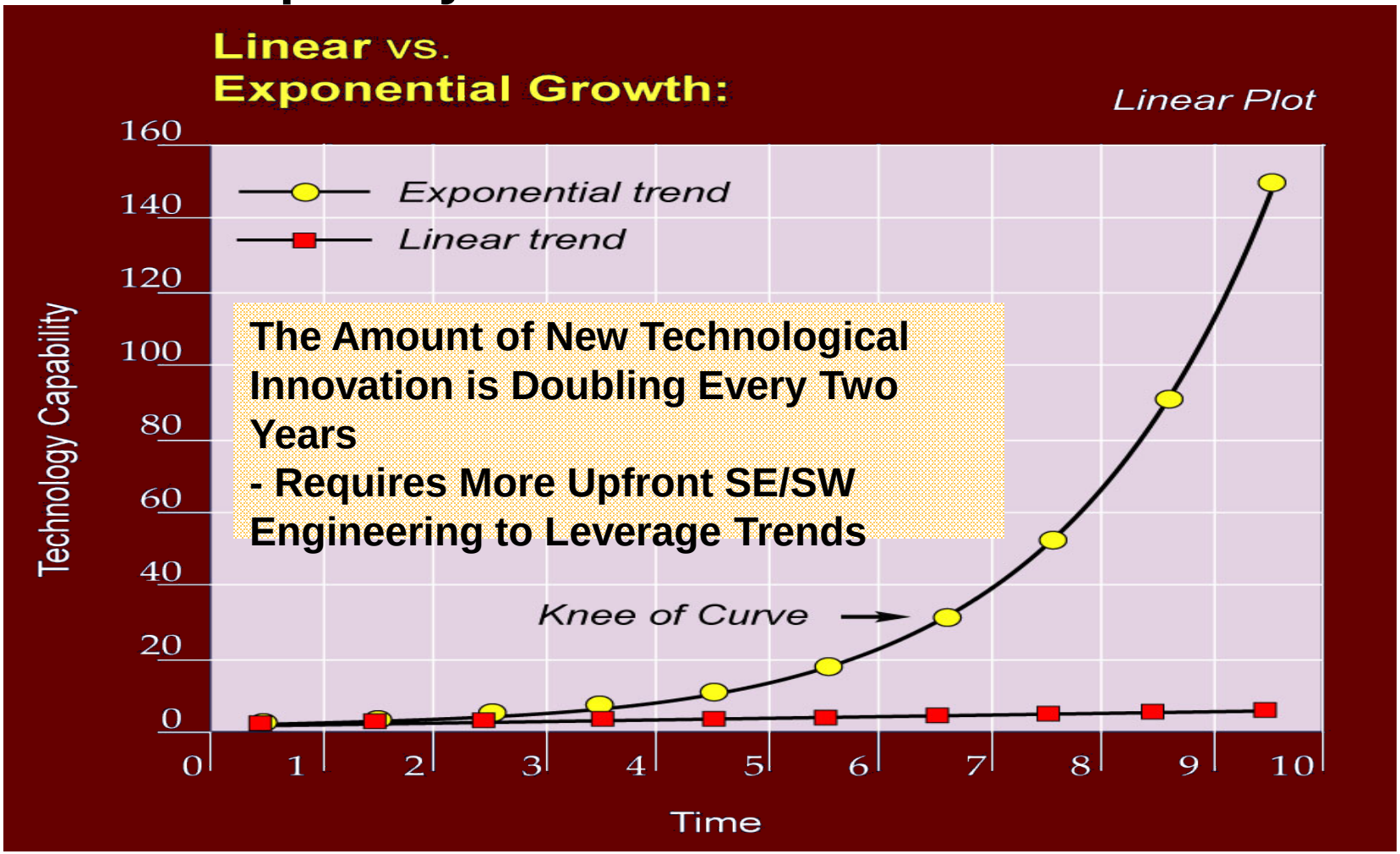


Source: LMSC

Professional Growth vs. Time

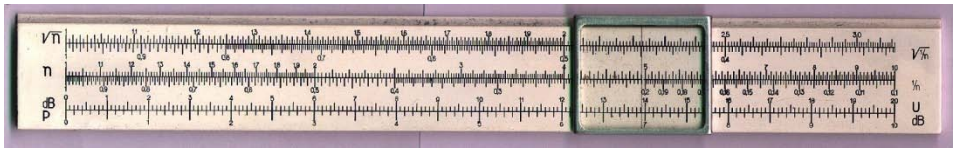
Source: DAU

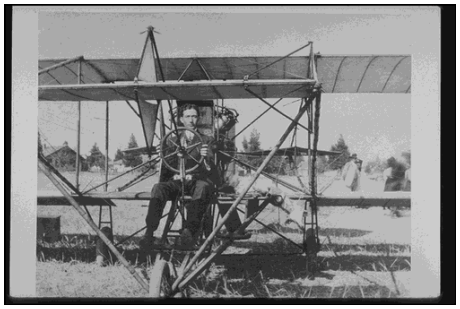
Technological: Acceleration of Innovation in the 21st Century - Facilitating Our Ability to Build Move Complex Systems



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

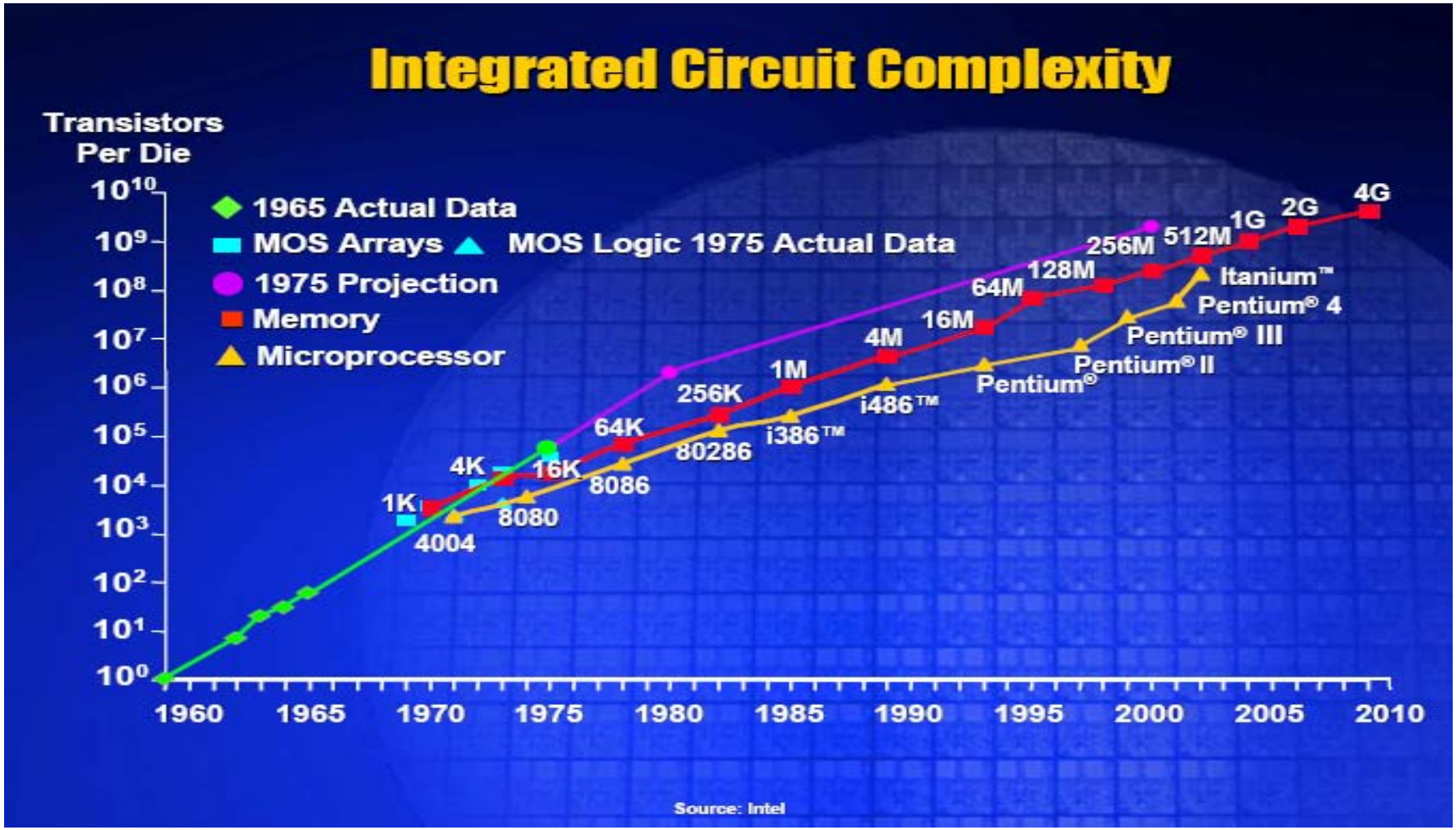
1990's

F-22
1.7M
LOC

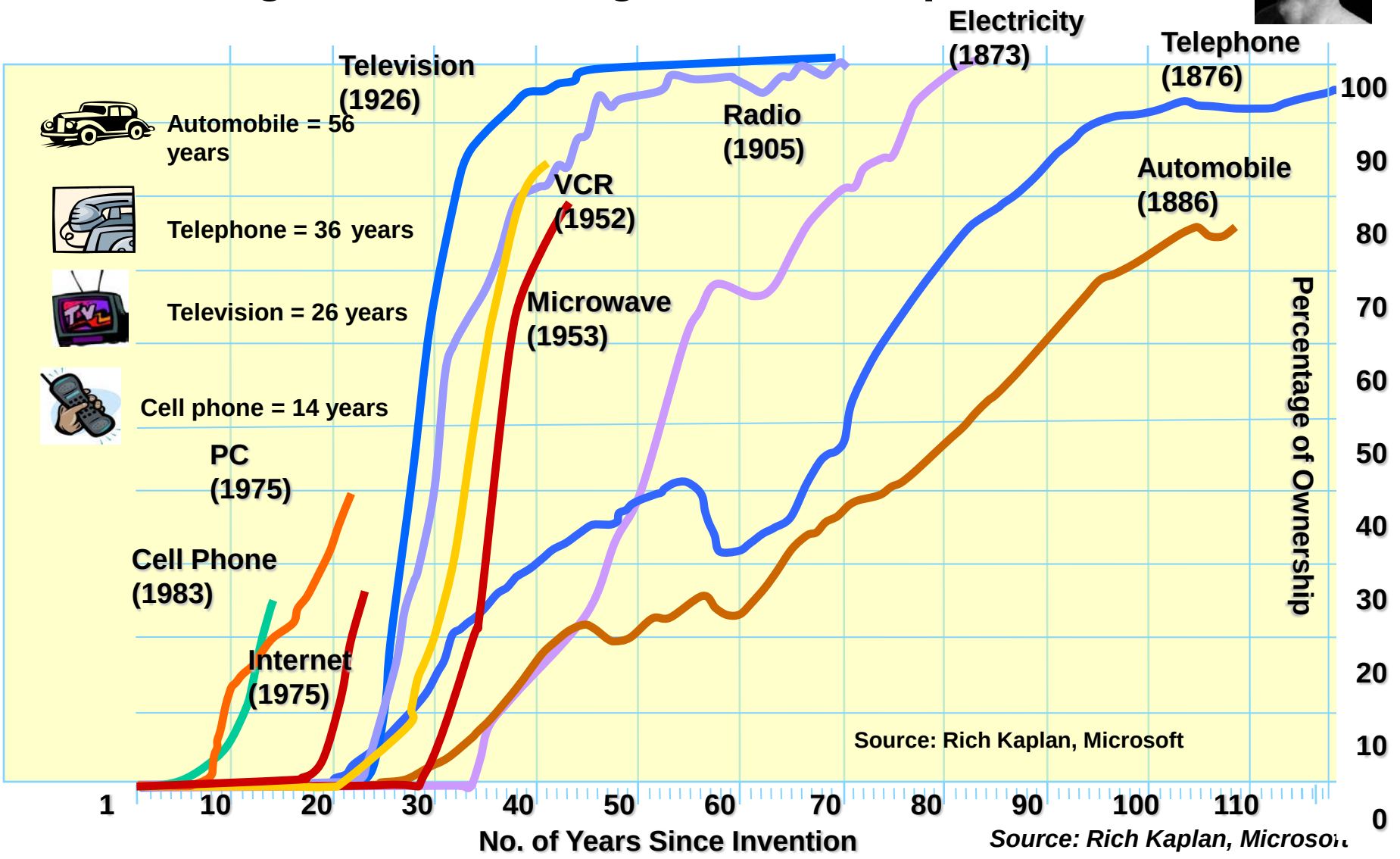
2000+

F-35
>6M
LOC

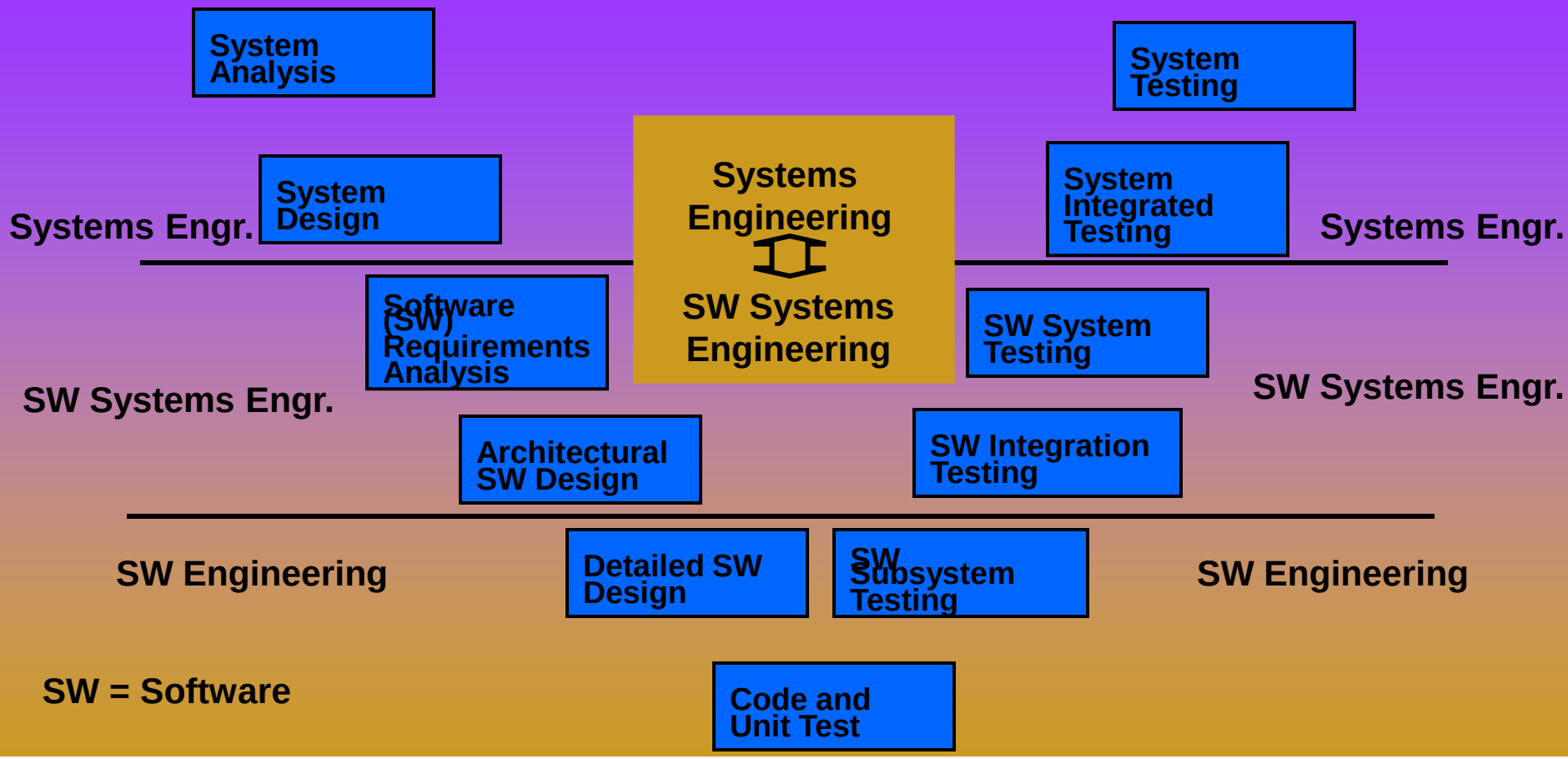
Technological: Moore's Law Holding - The Number of Transistors That Can be Placed on an Integrated Circuit is Doubling Approximately Every Two Years



Technological: Increasing Rate of Adoption



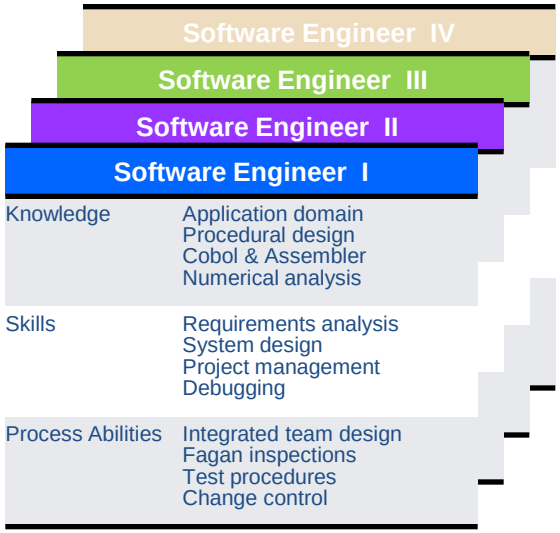
Human Capital: Refocusing University Curriculums - Alignment of Software Systems Engineering



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

Silent Generation
1928-1945

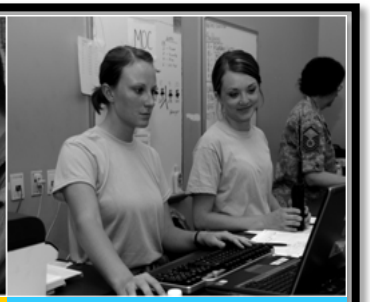
Hard worker
Respects authority
Work is obligation
Formal communicator
Work/family separation

Baby Boomers
1946-1964

Workaholic
Questions authority
Works efficiently
Competitive
Little work/life balance

Generation X
1965-1980

Technically advanced
Prefers informality
Needs structure and direction
Direct/immediate communicator
Seeks work/life balance



Generation Y/Millenials
1981-2000

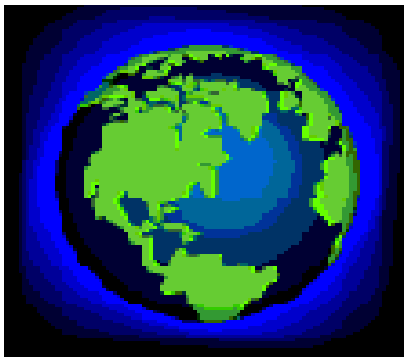
Technically savvy
Embraces diversity
Requires supervision
Indirect/virtual communicator
Demands work/life balance

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

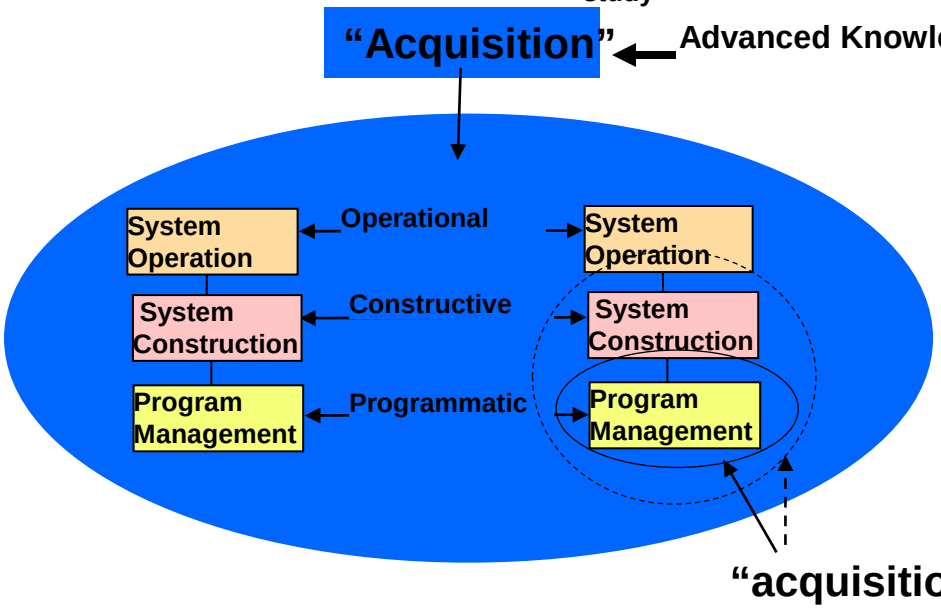
Client Business Environment: Acquisition Shifts

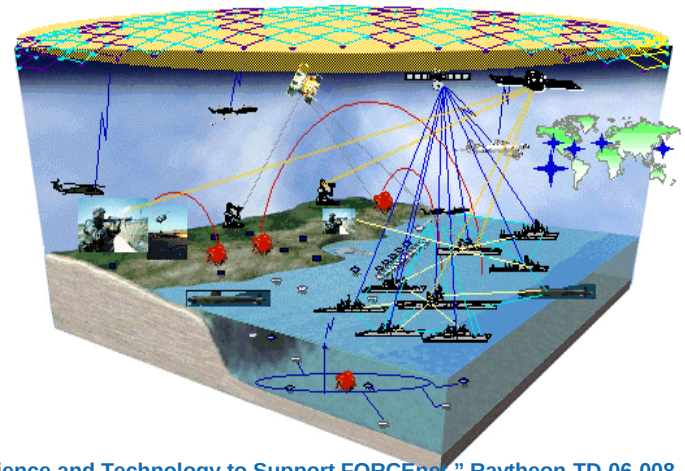


2005 study confirmed*:

- 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**





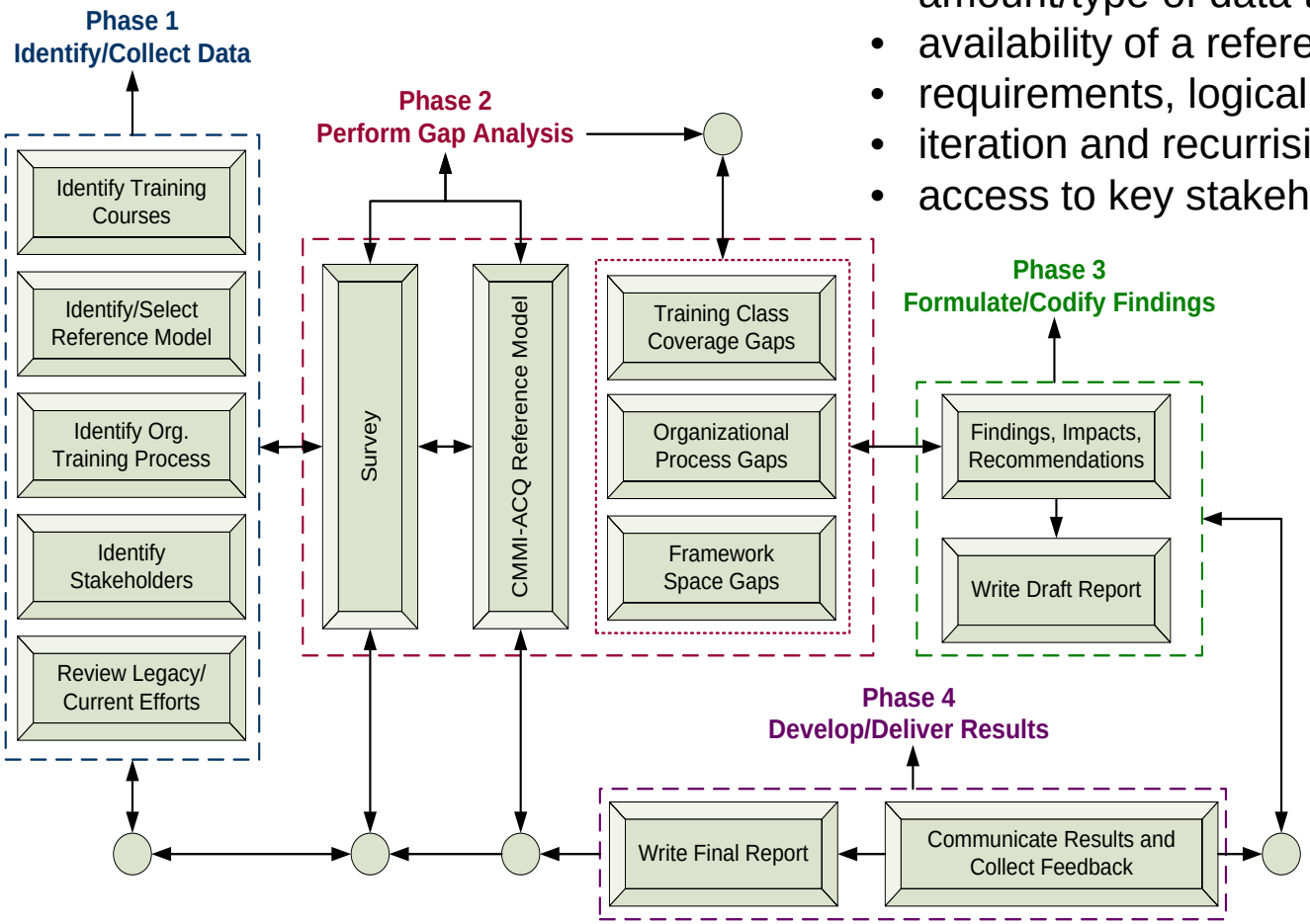
From "Science and Technology to Support FORCEnet," Raytheon TD-06-008. Used by permission.

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



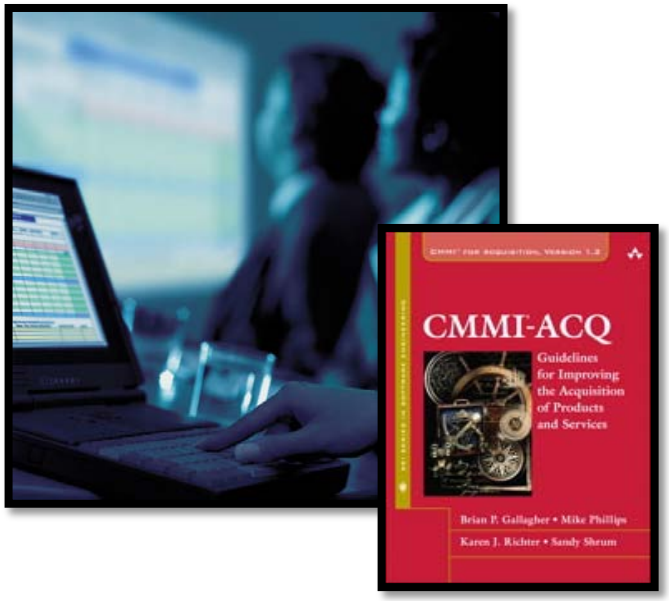
Project Objectives

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

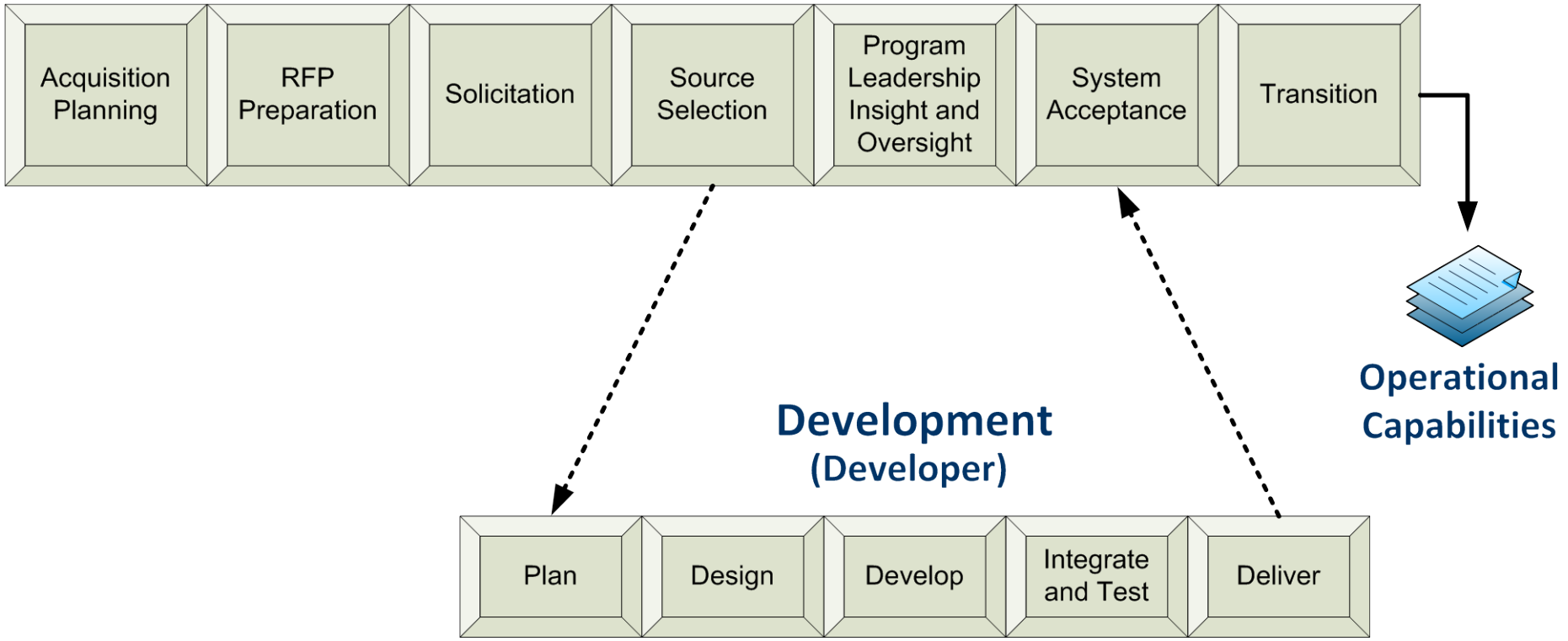
Evaluated client's acquisition training program components using Capability Maturity Model Integration® for Acquisition (CMMI® -ACQ) as reference model



Assessment Framework: *CMMI®-ACQ*

Operational Need

Focus on Acquisition Best Practices
(Acquirer)



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:

- Conducting a review to assess use of web-based and non-traditional acquisition training

Considerations:

Consider: Leveraging of efforts by DAU, commercial industry and academia

- Conducting a review of best practices for e-learning

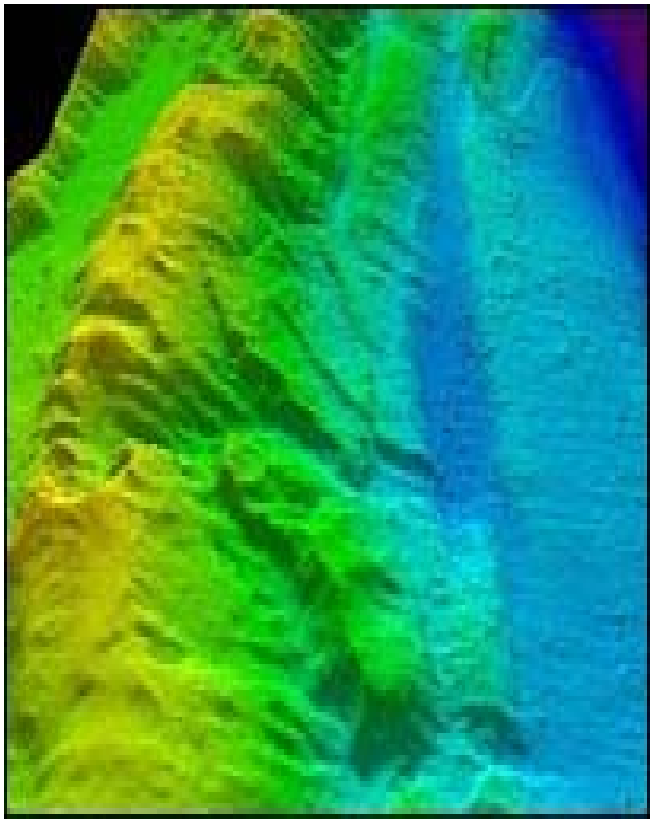
Consider: *Using* DAU's Acquisition Best Practices

- Making a better use of repository information

Lessons Learned

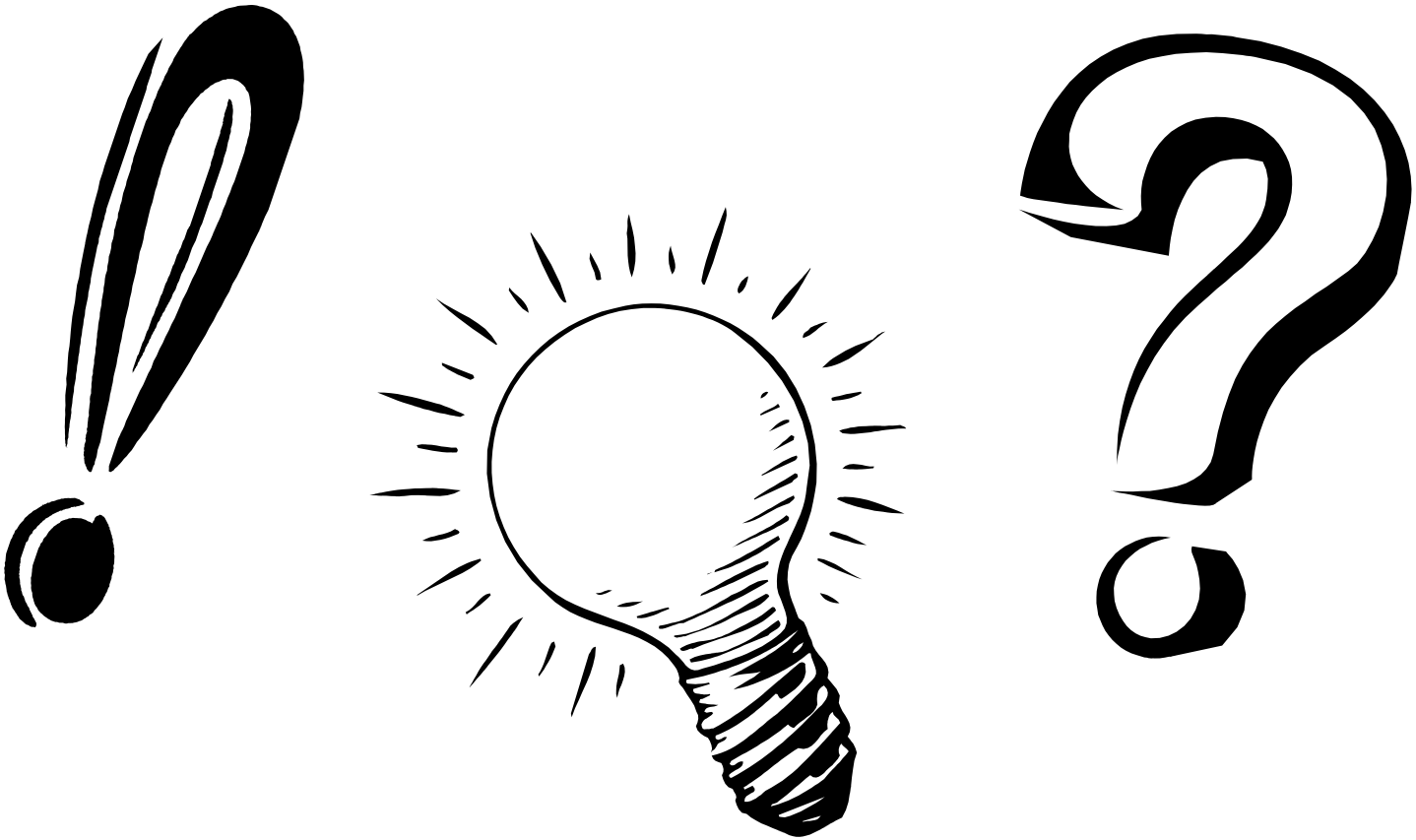
Tsunami

- 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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