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NPS
PRAESTANTIA PER SCIENTIAM

SYSTEMS ENGINEERING
ESTABLISHED 2002

Systems Engineering Expert Knowledge: SEEK

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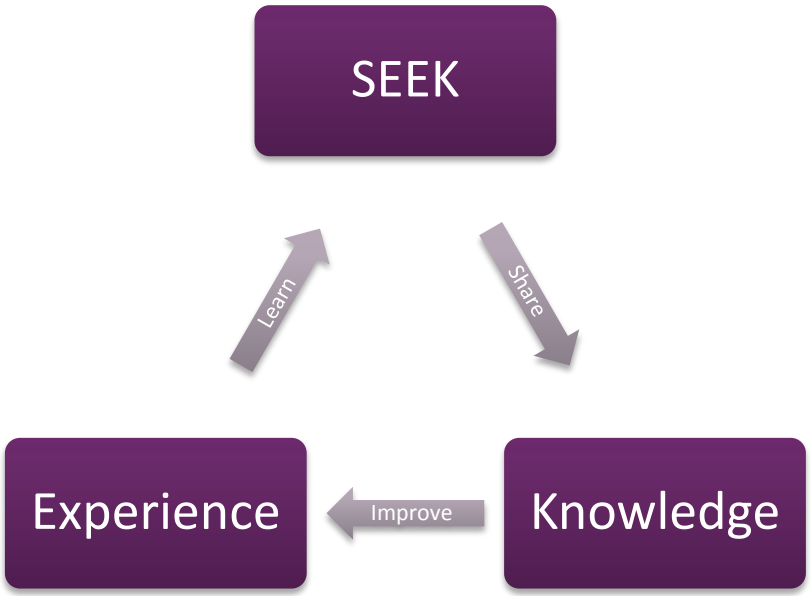
Human Capital Development: Systems Engineering Expert Knowledge (SEEK)



Summary:
Develop a series of case studies tailored to defense education needs to support instruction at the Defense Acquisition University, the Naval Postgraduate School, and other government education and training providers.

Funding: Received for FY14-15

Status:
Initial coordination complete with DAU

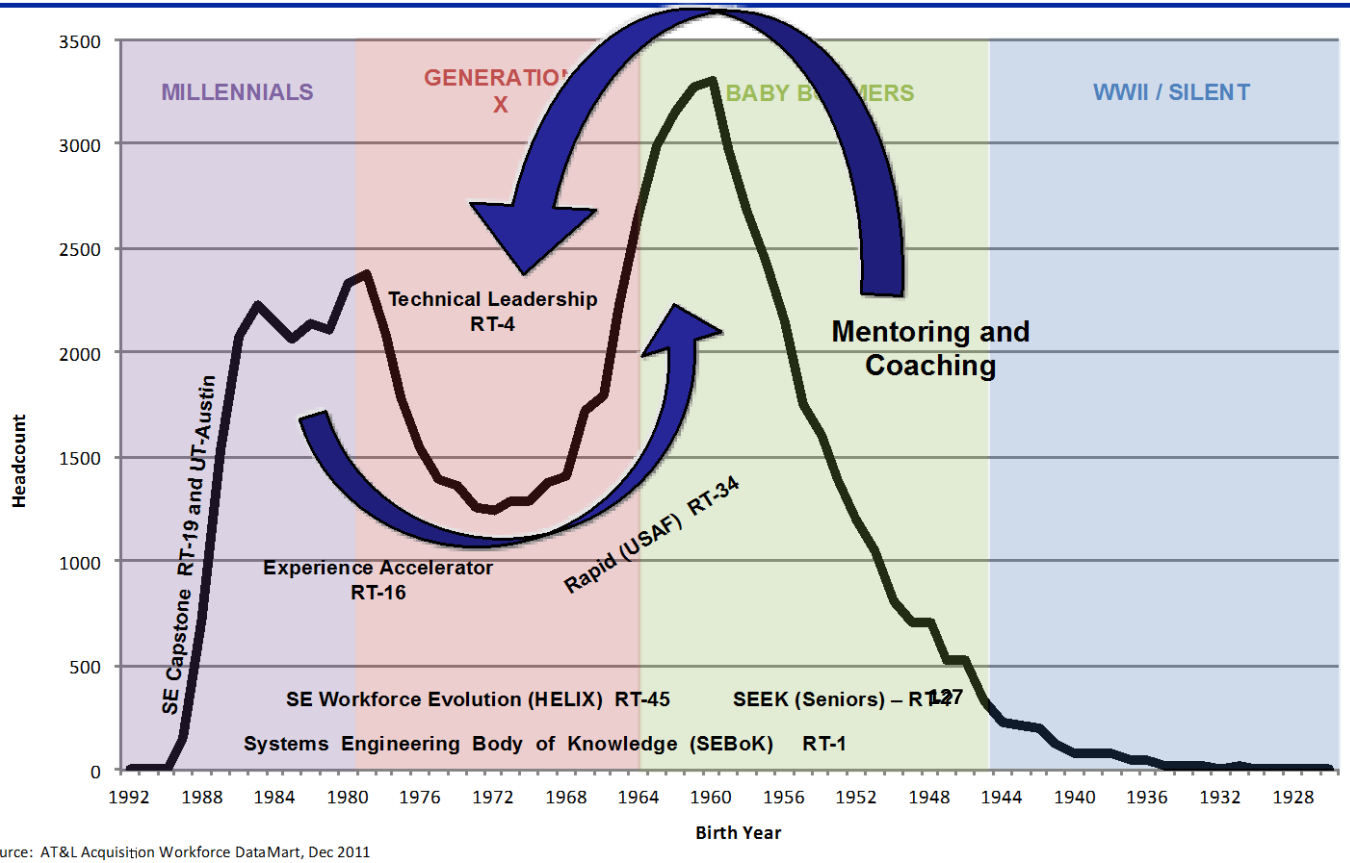
- determined stakeholder needs;
- defined interoperability requirements so that the cases can support both DAU and NPS, as well as other users.

Initial topics selected and coordination/data collection underway with data holders.

Impact: None to date.
Projected impact is improved SE **education and training** that incorporates actual lessons learned from recent DoD projects, that in turn **improves the practice of SE in DoD**.

Loss of experienced people

Engineering Challenges



Source: AT&L Acquisition Workforce DataMart, Dec 2011

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Value Proposition

The case studies to be produced:

- Are useful for educators and trainers, and are an important part of experience acceleration [5].
- Will integrate into the Systems Engineering Body of Knowledge (SEBoK) [6] – allowing the content to be classified into a widely accepted taxonomy and to support the principles identified in the SEBoK.
- Will complement DAU course modules, and other systems engineering instruction.
- May represent a significant part of the ROI for failed projects.

In some cases, shorter vignettes will be developed instead of full case studies.

- Balancing utility with thoroughness

Related Work

System engineering case studies are not new, but existing studies don't cover all domains of interest and contemporary practices.

We currently lack an infrastructure to capture and retain lessons learned about system engineering successes and challenges.

- The Air Force Institute of Technology published a set of case studies between 2004 and 2008 that focused on Air Force systems, including the C5, F111, Global Positioning System, and Hubble Space Telescope [1].
  - With the closure of the AFIT Center for Systems Engineering in 2012, no further case studies in that series are planned.
- NASA has a catalog of over 50 case studies, focused on spacecraft lift and payloads [2].
- A small number of programs have been the focus of isolated case studies: E.g., General Dynamics published a case study on the Virginia Class Submarine Program, as did Rand [3,4].
- But generally, there are few published case studies for land or sea systems.
- DAU's Living Library initiative captured, through 2008, lessons learned via video interviews from retiring System Engineering / System Acquisition personnel.

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Criteria for Program Selection

- Large scale (ACAT 1 or 2)
- Completed through T&E
- Relevant to current R&M practices
- Have available data
- Multiple services/domains
- Illustrative of a variety of R&M challenges: e.g., hardware, software, personnel, process, etc.
  - —Especially software
- Balance successes with challenges

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Targeted Programs (Priority Order)

• Expeditionary Fighting Vehicle	Marine Corps
• Trident D5 Service Life Extension	Navy
• GPS block 3 upgrade	multi-svc.
• Future Combat Systems	Army
• F-22	AF
• Broad Area Maritime Surveillance Unmanned Aircraft System	Navy
• Advanced Field Artillery Tactical Data System	Army / Navy
• Multi-band terminal (NMT)	Navy

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DAU SYS 3XX Themes for Cases

Case Study Topic
Development Planning and Early Phase Systems Engineering
Eliciting, Developing, and Analyzing Requirements
Identifying an Affordable Design, SE Affordability Trade-off Analysis
Designing, Producing, and Sustaining Reliable, Maintainable, and Supportable Systems
System Assurance and Program Protection
Controlling Cost Throughout the Product Life-Cycle
Transition to Production and Deployment
SE in Rapid Acquisition; Tailoring SE processes
Understanding Industry and Business Acumen
Planning, Managing, and Leading Technical Reviews
SE in Sustaining and Supporting Complex Systems

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Mapping System Artifacts to DAU Learning Objectives

TLO	Artifact Given or Role Assigned	Action	Topic 1 Planning	Topic 2 Design	Topic 3 Monitor	Topic 4 Reviews	Topic 5 T&E
EMD 4.1	EMD Integrated test plan	Evaluate					1
EMD 7.1	EMD R&M Test results	Evaluate					1
EMD 7.2	Contractor's alternative decisions	Evaluate					1
EMD 8.1	R&M test results	Evaluate					1
EMD 8.2	Failure Reporting and Corrective Action System (FRACAS),	Evaluate					1
EMD 10.1	Government system test plan, procedures and test results	Evaluate					1
EMD 13.1	Contractor R&M test plans	Evaluate					1
EMD 13.2	R&M test plan evaluation results	Provide Input					1
EMD/MCR 1.1	R&M results achieved during the EMD Phase	Evaluate				1	
EMD/MCR 1.2	Milestone C Review Overview - concluding EMD Phase	Recognize				1	
MSA 2.1	MSA Phase Government R&M program planning	Evaluate			1		
MSA 4.1	System R&M requirements analysis	Evaluate	1				
MSA 4.2	System description, operational factors and configuration identification	Evaluate	1				
MSA 4.3	Evaluation of R&M objectives documented in the ICD and	Recommend	1				
MSA 6.1	Trade Study	Evaluate	1	1			
MSA 7.1	Defense Acquisition System MSA major deliverables	Evaluate	1				
MSA 10.1	Test and Evaluation Master Plan (TEMP)	Evaluate					1

MSA 10.1: Given a Test and Evaluation Master Plan (TEMP), learner will evaluate the Reliability and Maintainability (R&M) inputs defining how R&M will be tested and evaluated in the associated acquisition phase.

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Targeted Data Sources

- Interviews with key government and contractor stakeholders.
- Technical assessments, program history, milestone review data
- EVM and other cost / effort progress measures
- Cost performance
  - Cf. “Performance of the Defense Acquisition System” annual reports from Mr. Kendall’s office
- DOT&E results

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Deliverables

- Case studies will include supporting video materials and could be delivered in two formats: one in the public domain in a PDF form with all permissions secured for distribution and a second version for internal DoD use.
- Case studies will include supporting technical documentation.
- The deliverables will be integrated into the SEBoK and be available to Defense Acquisition University and other venues such as the INCOSE SE Handbook.
- The SEEK researchers will also make presentations and publish papers to increase awareness and impact of the research.

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Challenges

- Proprietary data
- Reluctance to share the bad and the ugly
- Fostering a culture that values honest, quick, and non-attritional feedback (a la mishaps in aviation and peer review in medicine)

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Questions and discussion

- We would be very interested in hearing about:
  - —Potential case study users
  - —Suggestions on data and other sources of program insight

Contact us:

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