

Improving the Systems Engineering Workforce for the Department of Defense and Industry

**NDIA Systems Engineering Division
Education & Training Committee Co-Chairs**

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Avoiding Engineering Failures with Competent Systems Engineering



Tacoma Narrows Bridge Collapse, 7 November, 1940
Barney Elliott; The Camera Shop, Usable under fair-use principles only.

NDIA SE Division Education and Training Committee

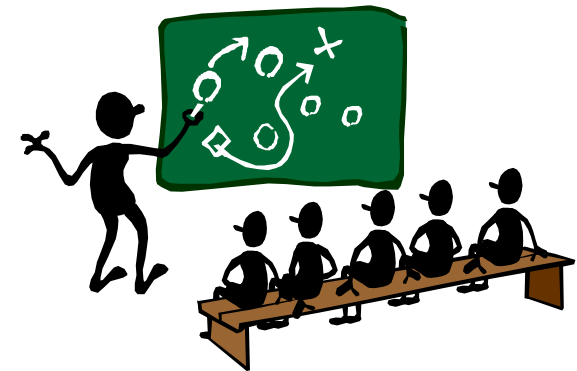
Objectives:

- Identify defense industrial base SE workforce challenges
- Explore how DoD policy and investments can aid in maintaining/growing critical capabilities
- Explore how we can attract, foster, and develop future DoD engineering leaders
- With the increased focus on government in-sourcing, explore how we can rapidly mature future program chief engineers



Approach

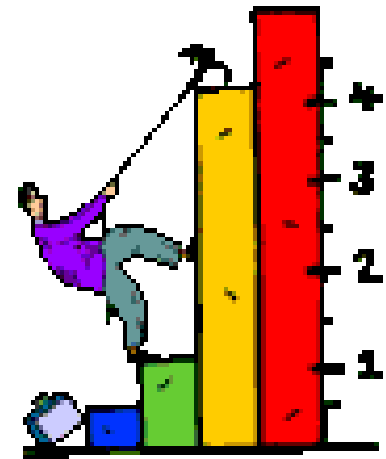
- Identified and analyzed the challenges
- Identified barriers to addressing challenges
- Identified enablers to addressing challenges
- Developed proposed solutions to leverage enablers and overcome barriers
- Formulated actionable recommendations



Workforce Challenges

How do we:

- Increase the number who enter the SE discipline?
- Identify the right mix of competencies and capabilities in the SE workforce?
- Increase the speed at which systems engineers mature?
- Increase the ability to deploy systems engineers more optimally within organizations?
- Attract and retain high caliber engineering leaders?



Barriers



Both Government and Industry:

- Children in the U.S. do not find STEM exciting
- Movement of people between government and industry is inhibited by conflict of interest rules
- In most organizations, pay and benefits encourage systems engineers to become program managers
- No agreement on the right amount of breadth vs. depth within a domain
- No agreement on the right amount of domain-specific vs. generic systems engineering
- Presumption that systems engineers are grown through “scar tissue” which can only be acquired through many years of experience

Barriers (Continued)



Both Government and Industry:

- Rotational assignments are hard to achieve in some cultures
- Scarce funding and overhead to support training
- Scarce availability of subject matter experts to support as trainers and mentors
- Managers tend to hold on to their best people

Government Only:

- Pay and benefits within government are not generally as attractive as those in industry
- Long hiring process

Enablers



- Many federal, state, local government, industry's active STEM investments and efforts
- Virtual technologies and approaches such as Webinars, on-line education, social/collaboration networks
- The Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE), which will establish an international guide to the body of knowledge for the SE field and a graduate reference curriculum for SE
- The International Council on Systems Engineering (INCOSE) professional certification program for systems engineers
- Joint industry/government training
- Making it easier to move between the government and industry without introducing any conflict of interests issues
- Moving work without moving people

Committee Proposed Solutions

- Leverage and integrate the use of remote technology to educate or collaborate
- Develop Joint Case studies and make them available to both government and industry
- Leverage BKCASE effort and SE Competency Frameworks
- Invest in gaming and other virtual technologies to rapidly simulate experiences
- Leverage IRAD/research projects to the greatest extent possible
- Promote application of SE in the sustainment of existing systems
- Establish rotational assignments within existing programs
- Establish rotational assignments with adjacent sectors, e.g. air traffic control, homeland security, and the census
- Establish policy on how to enable systems engineer exchanges between government and industry



Example Industry Solutions

General Electric Aviation

- Select proven engineering colleges & universities programs
- Recruit interns/co-ops only from programs
- Hire entry level engineers only from best of available interns/co-ops
- Run through company training programs
- Edison Engineering Development Program
 - Two year entry-level program consisting of at least three rotation assignments
 - Assignments are engineering projects and may include Systems, Design, Quality, and Validation
 - First year coursework includes advanced engineering topics to develop technical skills
 - Second year coursework includes corporate leadership topics to develop business skills
 - Program members are encouraged (if not required) to earn credit towards an MS degree in Engineering while on program
- Benefits: Less turnover, higher competent workforce, higher worker and employer satisfaction



F414-GE-400 engine (U.S. Navy photo by Mass Communication Specialist Seaman Stephen W. Rowe/Released)

BAE Systems

- Engineering Leadership Development Program
 - Similar to GE’s Edison Engineering Development Program



U.S. Army M3A3 Bradley Fighting Vehicle System (U.S. Air Force photo by Staff Sgt. Jason Robertson/Released)

Lockheed Martin

- “Engineering Leadership Development Program (ELDP) is an entry-level technical leadership program designed to develop a pipeline of future engineering leadership talent enterprise-wide”
 - Rotational Assignments
 - Technical Development Curriculum
 - Leadership Development
 - Leadership Development Conferences
 - Mentoring & Networking

F22 Langley AFB (Photo courtesy of Lockheed Martin)



Other Existing Solutions

DoD can provide an incentive for industry to grow and develop its engineering workforce

– Increase allowable profit on DoD contracts

– A company's investment to hire and develop its workforce's abilities, experience, and professional credentials support an argument for higher profit when DoD contracting officials apply weighted guidelines on profit on DoD contracts

- **Industry Volunteer and Financial Support of their own STEM and / or other STEM Initiatives**



Recommendations



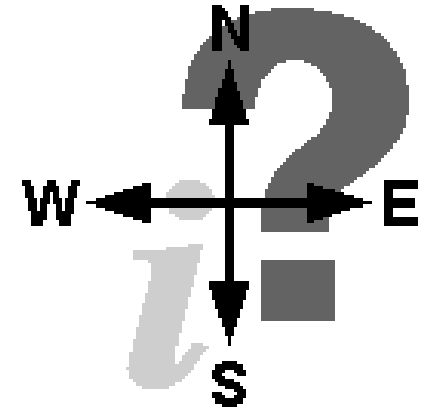
- Continue supporting the DDR&E STEM Initiative Goals:
 - Inspire, Develop, Attract and Deliver
- Develop and Support More:
 - Co-Op/Intern Programs
 - Mentoring Programs
 - Rotational Assignment Programs
- Provide more opportunities for workforce development initiatives between government and industry

Recommendations (Continued)

Encourage the provision, adoption, development, and use of:

- Joint government and industry case studies and other lessons learned documents
- Distance Learning Courses
- Systems Engineering Experience Accelerator, when complete
- The Guide to the Systems Engineering Body of Knowledge, when complete
- The Graduate Reference Curriculum for Graduate Systems Engineering, when complete





Questions?



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