



33rd Annual **INCOSE**
international symposium

hybrid event

Honolulu, HI, USA
July 15 - 20, 2023



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Improving Systems Engineering Competency and Capability in an Organization

Agenda

- Background
- Identifying the SE workforce
- Building the community
- Motivating for change
- Inspiring further growth
- Formalizing competency
- Conclusion & additional recommendations

Presentation Structure

For each topic:

The challenge

Actions taken

Successes

Recommendations

Background

- 1400 person organization
 - ~800 Scientists and Engineers
- Limited formal exposure to SE discipline
- 5 year effort
- 1 lead, full time
- Slow shift in nature of work: less S&T, more production/test/support
- Reduced technical assertiveness
- Decrease in technical rigor when the need for it was increasing

Identifying the SE Workforce

The challenge:

- Despite DoD bureaucracy, SE positions not well defined!
 - No “GS-XXX” series
 - DAU SYS coding
- Academic SEs generally have industrial focus
- “Morphing” from disciplined engineer to SE
 - Given enough time on a system, the EE or ME became an SE.

Identifying the SE Workforce

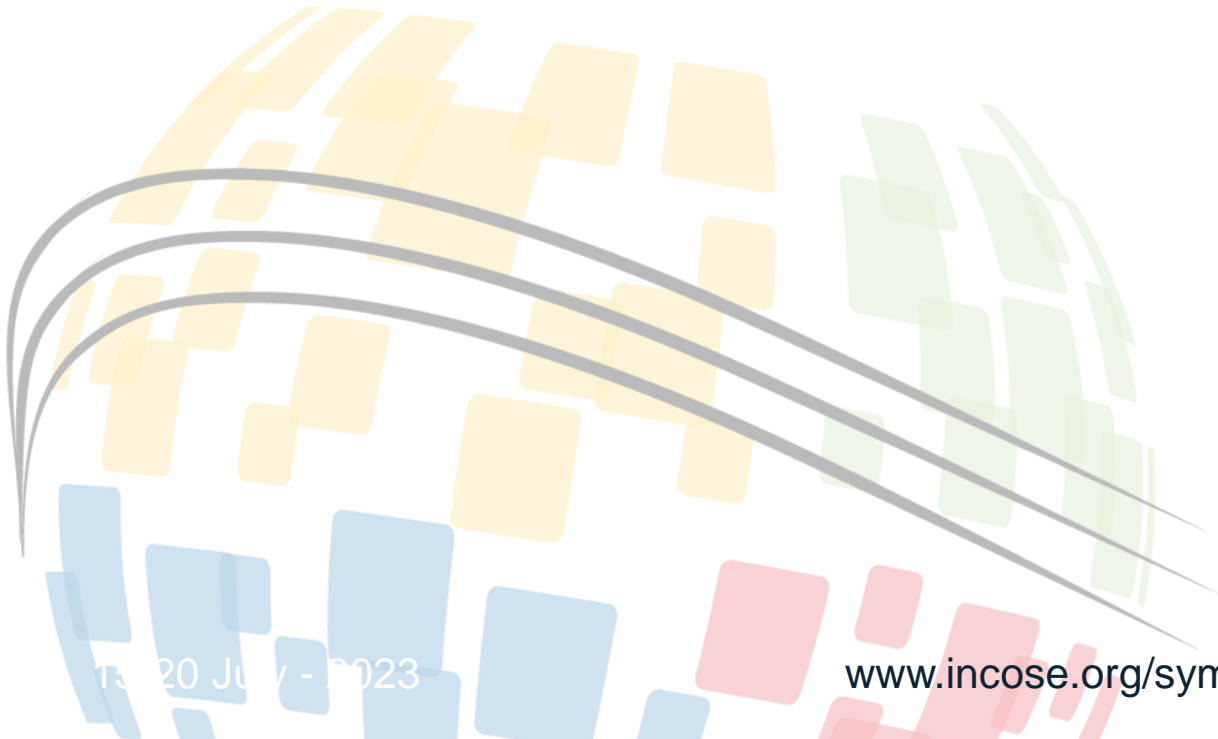
Actions taken:

- Inherited cohort list
- Additions:
 - Organizational charts – enterprise level and project level
 - Self-nominees welcome at any time
 - Recommendations from supervisors at any time
 - Organizational listings/binnings
 - Open invitation

Identifying the SE Workforce

Successes:

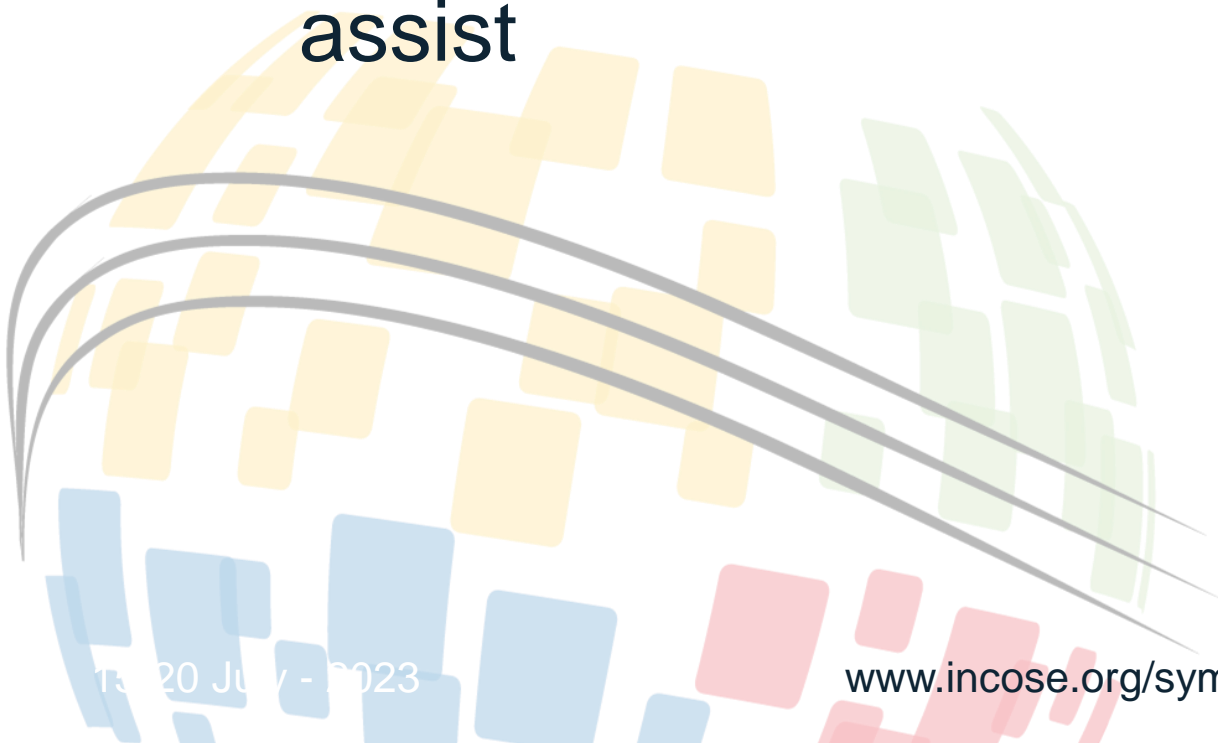
- 150 to 300
- Set the stage



Identifying the SE Workforce

Recommendations:

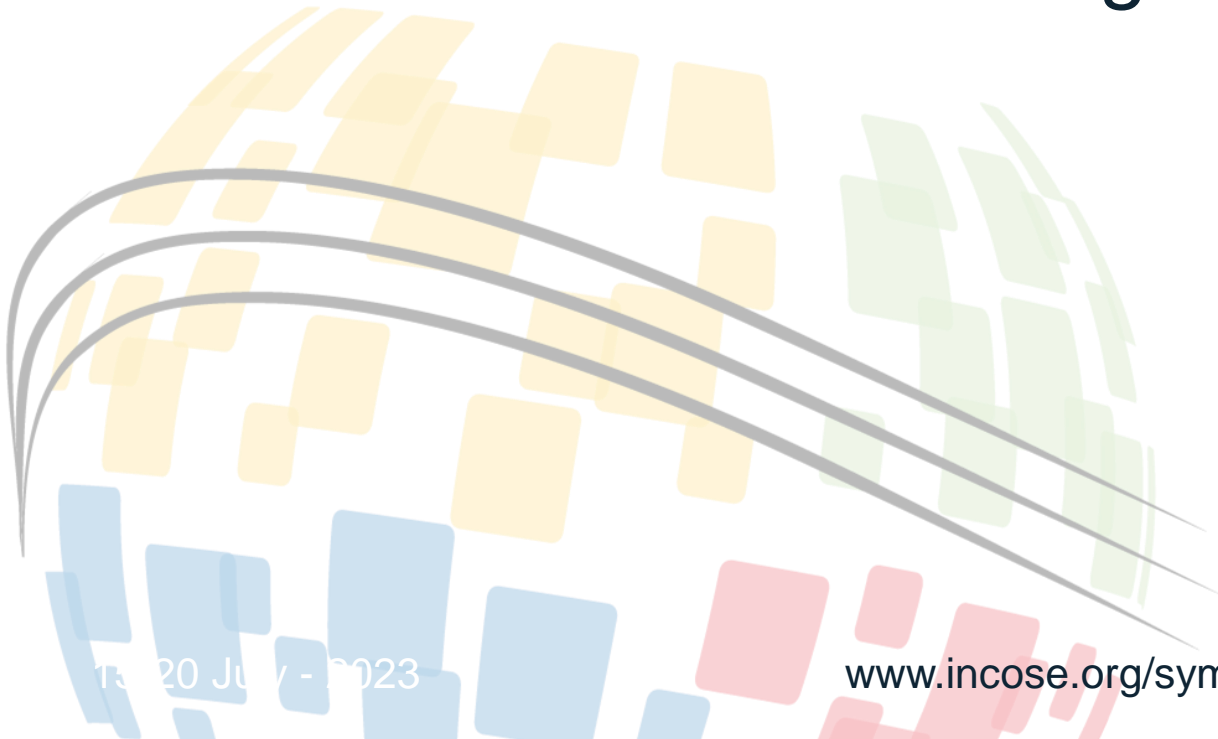
- Tailor this to your intent
- Consider enlisting your Human Resources team to assist



Building the Community

The challenge:

- Product aligned organization
- “I know what I’m doing” mentality



Building the Community

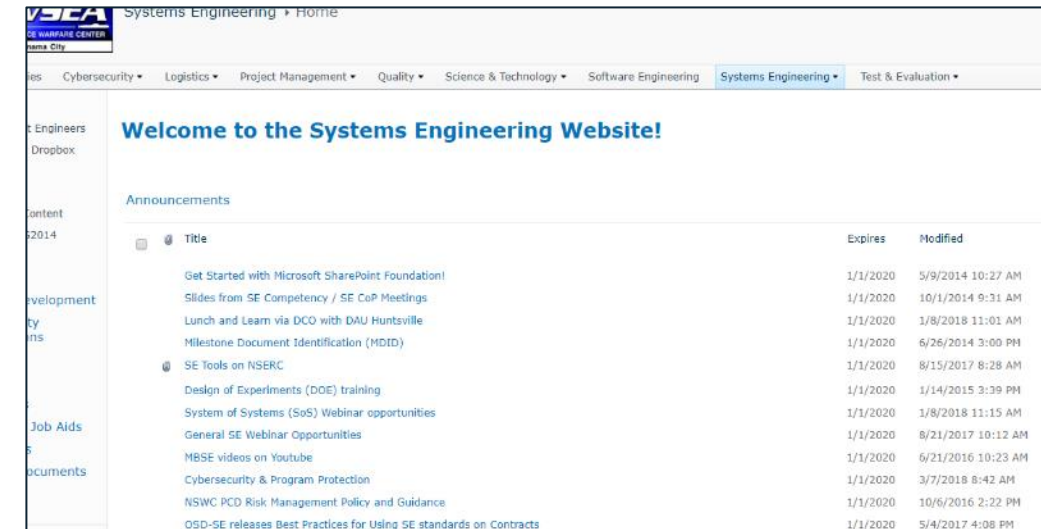
Actions taken

- Established a community of practice
 - Quarterly meetings, entire community
 - Dept aligned SSE “reach out” sessions, biannual
 - Sharing of external information of benefit (INCOSE!)
 - Offers to speak at branch level meetings (only 3 of 40 accepted)

Building the Community

(additional) Actions taken

- Established resources and on-demand access to information
- Watched for common issues during project reviews
- Attempted to provide coaching for project teams



Building the Community

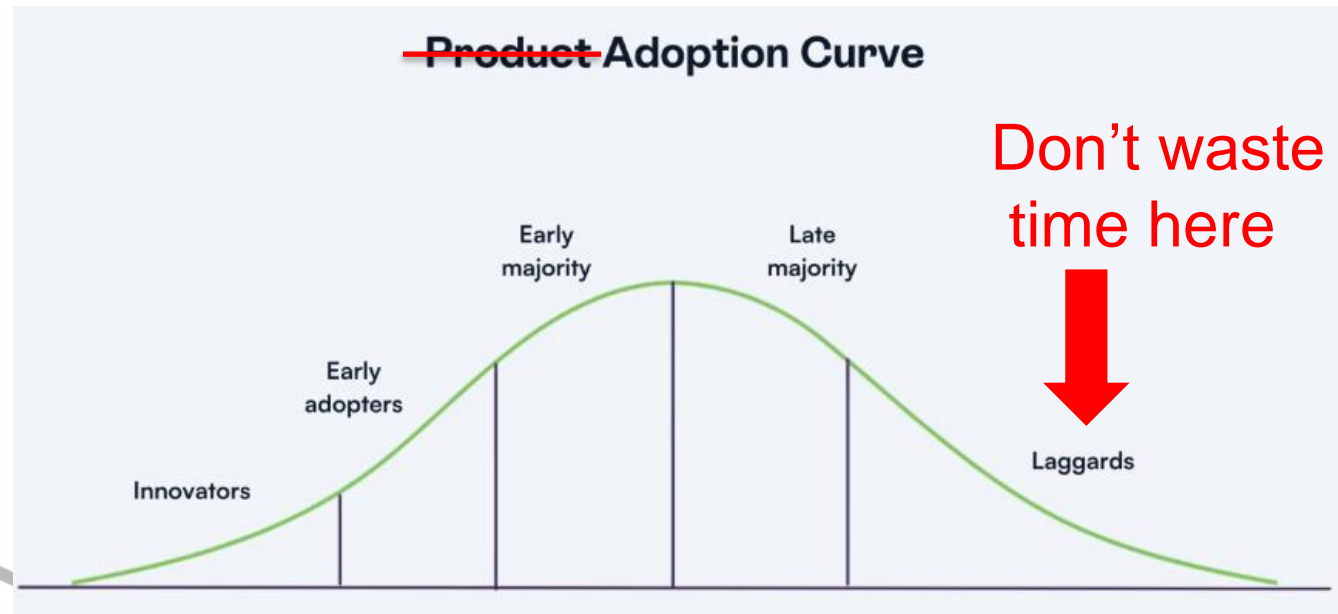
Successes:

- Frequent opportunities for networking and communication
- On-demand information
- Identification of common challenges

Building the Community

Recommendations:

- Know your audience



- Engage senior leadership

Motivating for Change

The challenge:

- Demands of “real work”
- Limited support, no support, or actual resistance from line managers

Motivating for Change

Actions taken:

– Training courses

- Identify those most needed
- Champion getting them hosted
- Tailor the courses to be highly relevant and applicable
 - SE Planning – used actual SEPs and had teams critique them
 - Co-taught some courses, provided intro/local context for others
- “Market” to get the right people there

Motivating for Change

Actions taken:

- SE Process definition

- Domain and project formality agnostic, plain English, tons of references, tied to SETR events and **artifacts**
- Taught 4 hour class, recorded and posted for on-demand viewing
- Navigable website of content (on-demand)

Motivating for Change

Actions taken:

The screenshot displays the Rational Method Composer interface. On the left, a 'My View' pane shows a hierarchical tree of project components. The main workspace on the right is titled 'Chapter 2 - Systems Engineering > 2.1 Technical Processes > Requirements Definition and Analysis > Gather Documented Requirements'. It details a task with its purpose, roles, inputs, steps, and key considerations.

Rational. Method Composer

Search this Site:

My View

- Welcome
- Chapter 1 - Project Management
- Chapter 2 - Systems Engineering
 - 2.1 Technical Processes
 - Requirements Definition and Analysis
 - Identify Stakeholders
 - Gather Documented Requirements**
 - Analyze Requirements
 - Resolve Requirement Issues
 - Decompose Requirements
 - Finalize Requirements
 - Architectural Design
 - Design Implementation
 - Design Integration
 - Verification
 - Validation
 - Transition
 - 2.2 Technical Management Processes
 - Technical Planning
 - Requirements Management
 - Configuration Management
 - Risk Management
 - Decision Analysis
 - Technical Assessment and Control
 - Technical Data Management
 - Interface Management
- Chapter 3 - Software Engineering

Chapter 2 - Systems Engineering > 2.1 Technical Processes > Requirements Definition and Analysis > Gather Documented Requirements

Task: Gather Documented Requirements

In this task you collect any existing documented requirements

Roles

Primary Performer:

- Systems Engineer

Additional Performers:

- Logistician
- Stakeholder
- System Test Engineer

Inputs

Mandatory:

- Stakeholder List

Optional:

- None

The purpose of this task is to research and gather all existing documented requirements, collect them in one place while maintaining awareness of where they originated.

Steps

Expand All Steps Collapse All Steps

- 1- Collect Documents
- 2- Ensure All Stakeholders Represented
- 3- Capture
- 4- Organize

Key Considerations

For a non-acquisition program, you will probably be relying heavily upon less formal documents such as briefing slides, white papers, even meeting minutes or e-mails from key stakeholders.

If not using DOORS, MS Word or Excel can suffice, but ensure you can still trace any single requirement back to its source.

Organizing the requirements into major categories helps manage the requirements and also helps identify gaps.

BEST PRACTICE:

If a CONOPS or similar does not exist, consider generating one. Concepts of Production, Deployment, Support (maintenance) and Disposal are also of value in identifying all relevant requirements. A Design Reference Mission Profile (DRMP) detailing a profile of the conditions a system is expected to encounter during its lifecycle is also valuable. Putting thought into these factors now reduces problems and rework later.

Motivating for Change

Actions taken:

The “SE Artifact Challenge”

- Created desired friendly competition
- Tied to defined SE processes (but not all caught that!)
- Received 19 project submissions, 552 files including some MBSE models!
 - Largest submission: 128 files
 - Smallest submission: 3 files
 - Oldest document received – from 1989!
 - Item received most frequently – Technical Assessment & Control meeting documentation (weeklies, forms, checklists, decision records)
 - Item received least frequently – Validation Meeting minutes (aka TRR type event), Data Management Plan

Motivating for Change

Actions taken:

Winning team got



3 Honorable mention prizes

- Best tailoring
- MBSE approach (2)

Motivating for Change

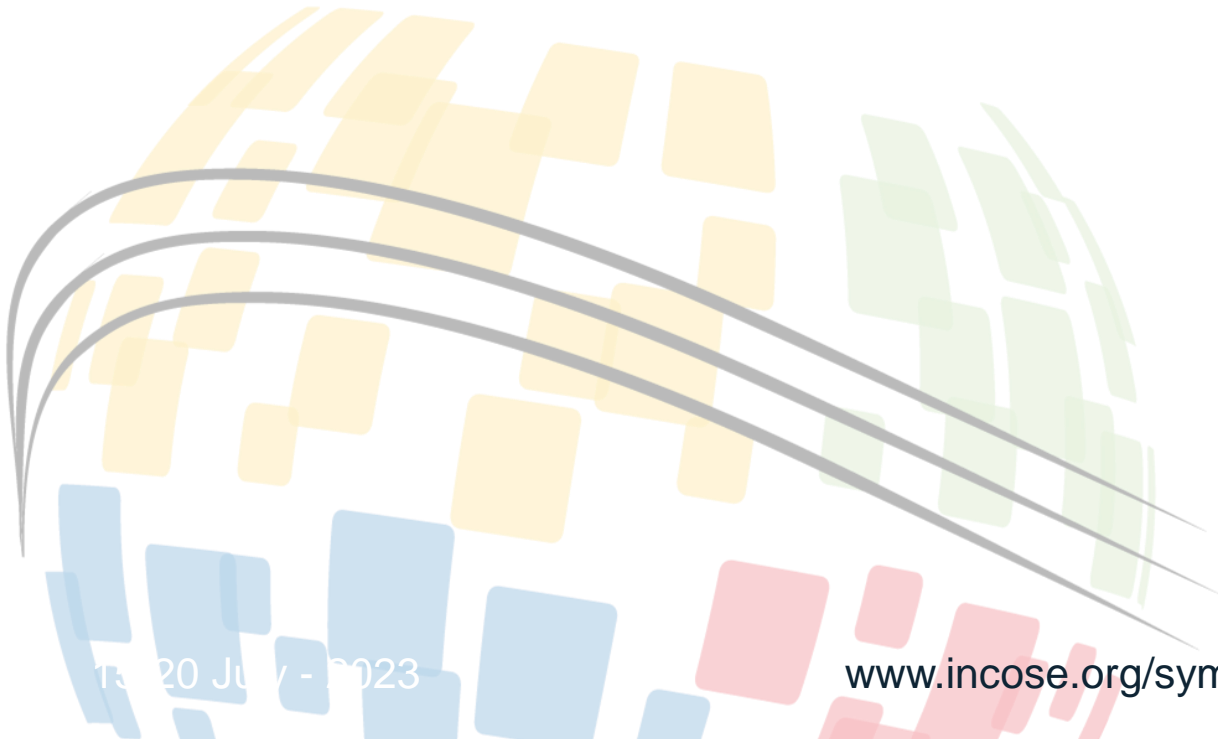
Successes:

- On-demand resources
- Thoughtfully curated training
- Peer challenges

Motivating for Change

Recommendations:

- Seek out contextual information

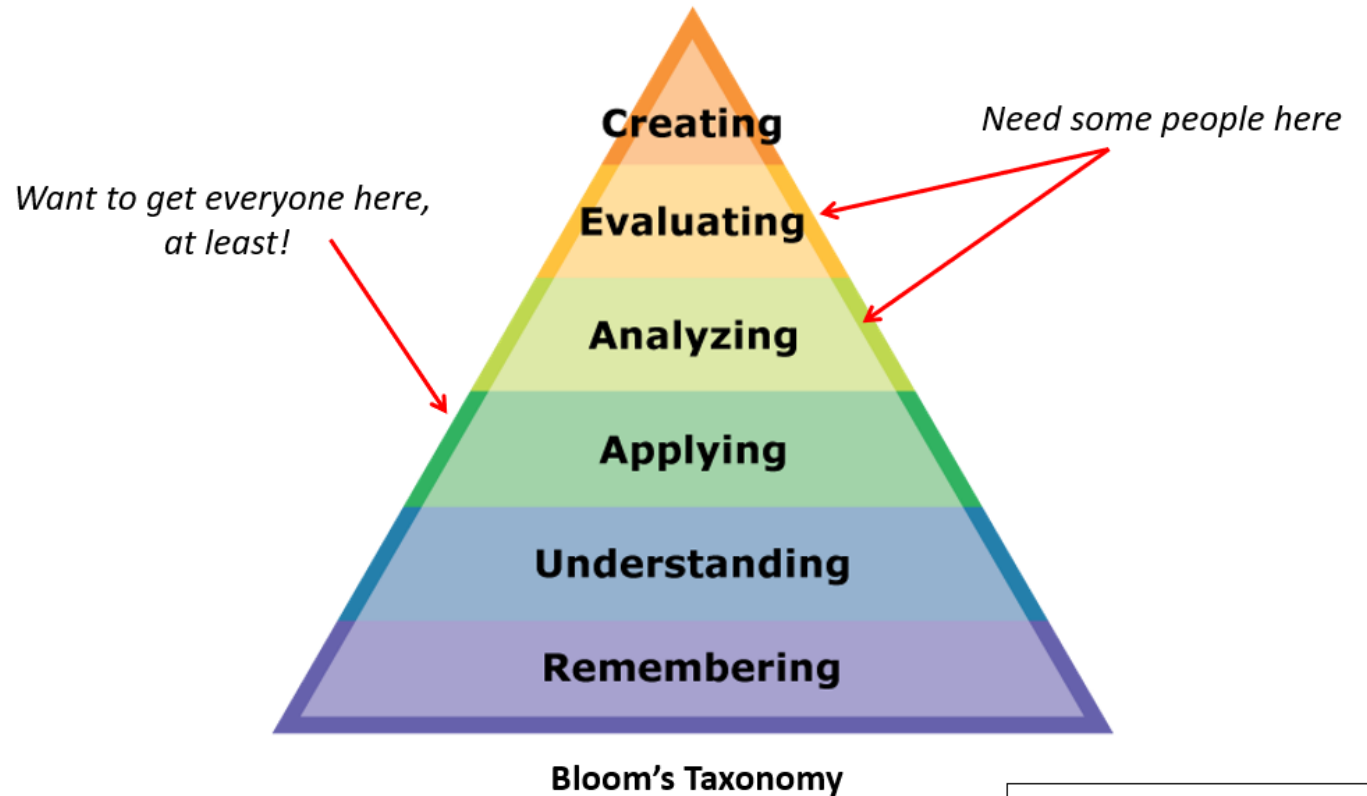


Inspiring Further Growth

SE Competency Vision

The challenge:

- “I’m fine”
- “I’m busy”



Credit: Bloom & Krathwohl, 1956,
revised Lorin Anderson, 1990

Inspiring Further Growth

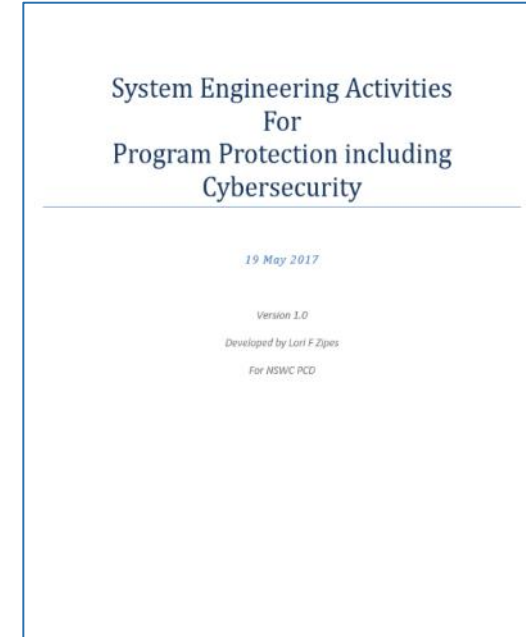
Actions taken:

- Expose
 - to INCOSE and NDIA SE events
 - Required payback – present at CoP session
- Empower
 - MBSE CoP self-formed
 - Endorse and enable, but let them lead
- Educate
 - MSSE programs, organizational sponsorship

Inspiring Further Growth

(additional) Actions taken:

- Enable
 - MBSE courses & tools
 - Cybersecurity guidance
 - Career Planning guidance



Inspiring Further Growth

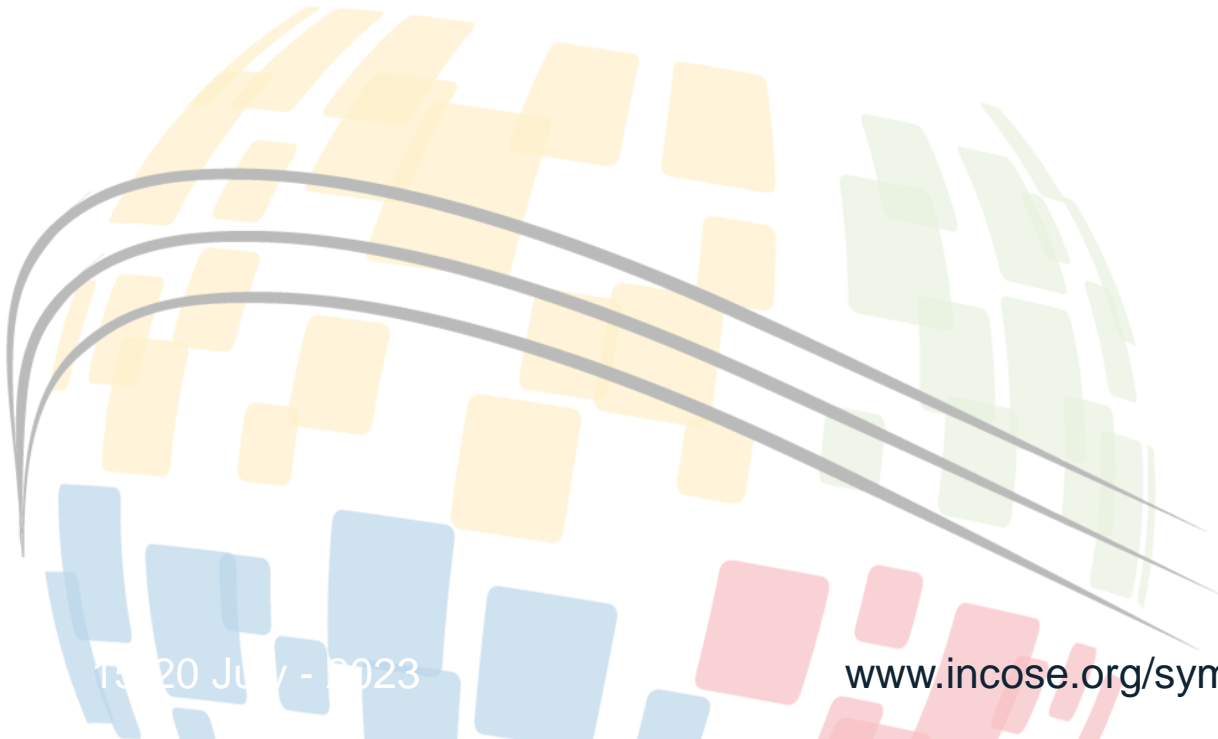
Successes:

- Broaden exposure and understanding
- Encourage and empower initiatives
- Keep the challenge high

Inspiring Further Growth

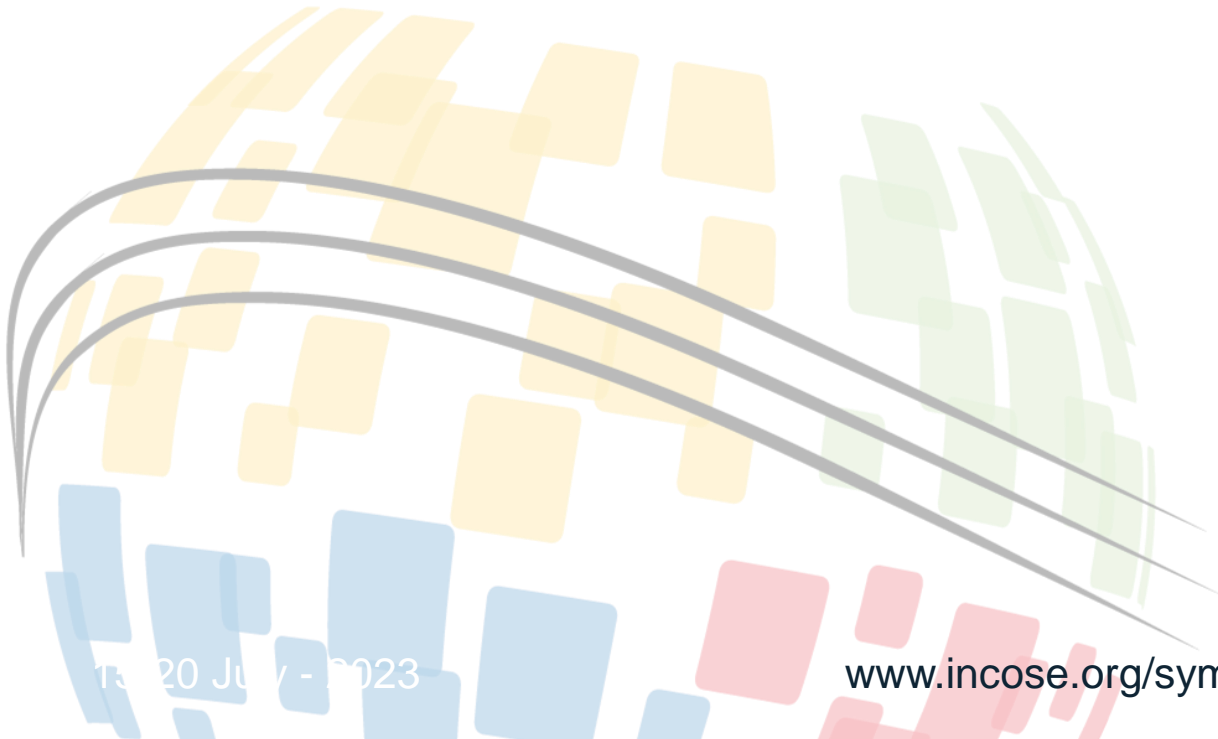
Recommendations:

- Invest intentionally and thoughtfully
- Consider external collaborations



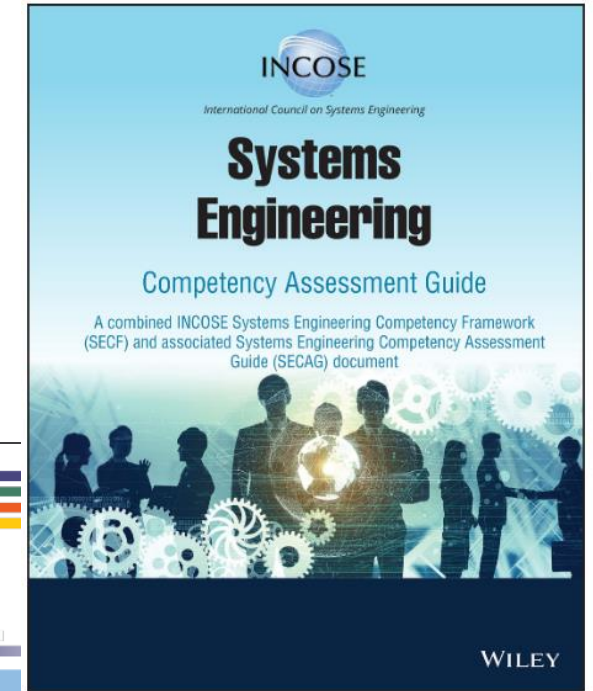
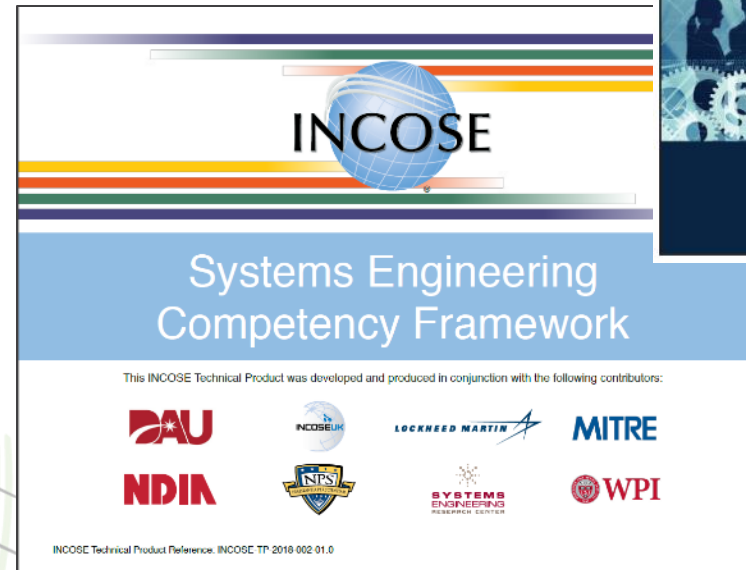
Formalizing Competency

- The challenge:
 - Ensure long term persistence of something “new”



Formalizing Competency

- Actions taken:
 - Well-defined position requirements
 - Qualification process



Formalizing Competency

SE Qualifications

Modeled off INCOSE program, customized



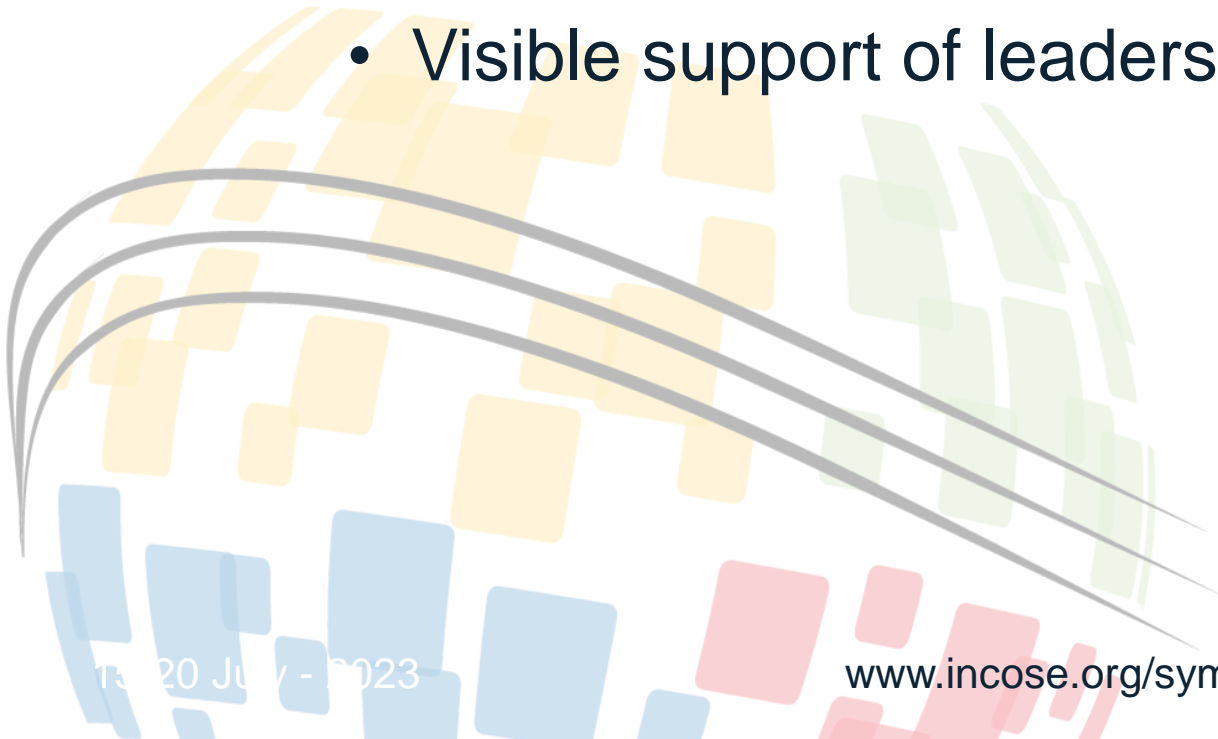
Well received by younger employees.
Not as well received by older employees!

Formalizing Competency

- Successes:
 - Common position description for Senior SE positions, tailorable
 - Qualification standard & process, pilot and limited implementation

Formalizing Competency

- Recommendations:
 - Clarify the goal of the formalization effort
 - Voluntary or compulsory
 - Visible support of leadership



Additional Recommendations



Additional Recommendations

It's a culture shift

- This is not just about providing training and implementing processes, it is a true culture shift
 - Leadership buy-in and active support is crucial

"Any serious review of failed change initiatives shows that **the number 1 cause of failure is a lack of focused and active support from senior management. People believe what they see on an ongoing basis.** People will only be convinced when they see sustained good behaviors and active involvement from the management/leadership team."

<https://www.processexcellencenetwork.com/business-process-management-bpm/articles/seven-questions-leaders-should-ask-before-starting/>

Additional Recommendations

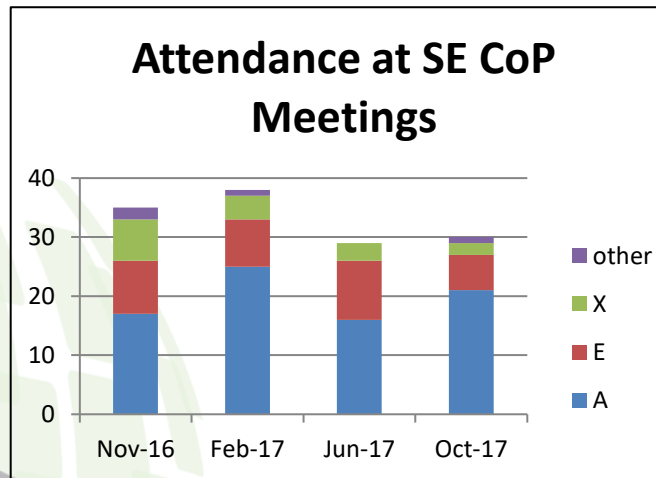
It's a system

- Be aware of where you “fit.”
 - “Staff weenies” generally not engaged with (or uniformly respected by) direct workforce
 - Proactively engage with everyone
 - Strive to be a resource first and foremost
 - Leverage your allies, & recognize/reward them
- Be aware of your interactions and impacts
 - SE touches lots of other disciplines, don't work in a vacuum
 - Pilot new guidance or efforts with trusted allies

Additional Recommendations

Data matters

- Track attendance and participation, and impact



- Volatility
- Errors / rework
- Speed
- ...

Additional Recommendations

Beware of organizational “immune response”

- Find the productive range of distress
- Challenge and leverage your early adopters
- Proactively engage with everyone
- Guide subtly – use “tricks” mentioned to encourage self-discovery

Additional Recommendations

It's a journey

- Small improvements over time lead to big gains
- Consistency brings clarity
- “We are what we repeatedly do. Excellence, then, is not an act, but a habit.”

By Will Durant based upon the writings of Aristotle





Questions?



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www.incose.org/symp2023
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