

When Less is More – Creating a Systems Engineering Essentials Course

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NIWC Pacific Overview



Naval Information Warfare Center (NIWC) Pacific provides technological and engineering support critical to information warfare for the U.S. Navy, as well as for Marine Corps, Air Force, Army and Coast Guard programs.

Systems development and support includes basic research and prototype development through systems engineering, and integration to life cycle support of fielded systems.



Designing and Delivering a Systems Engineering Boot Camp

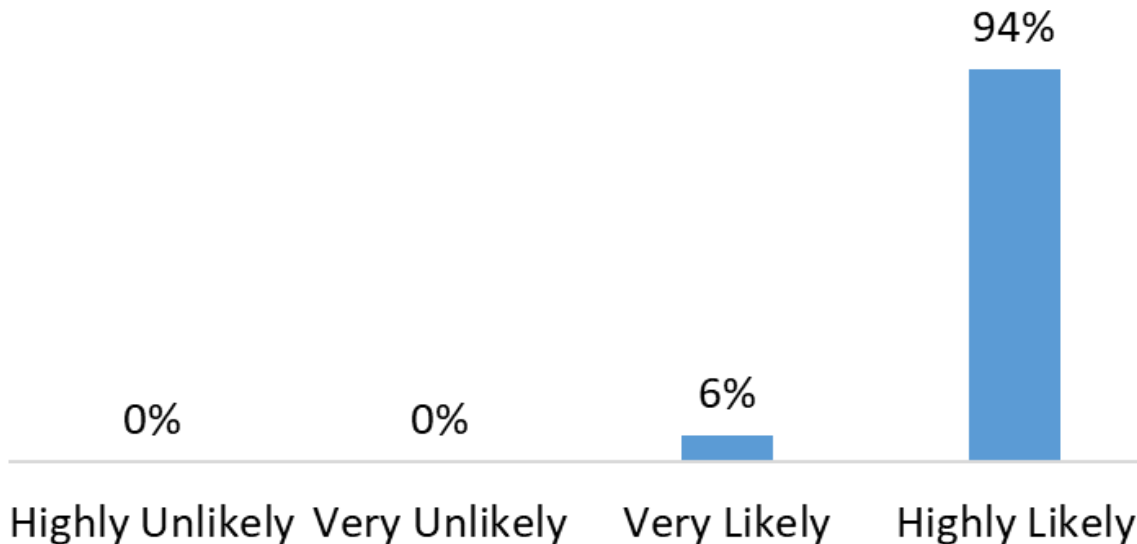
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Naval Information Warfare Center Pacific

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How likely are you to recommend this
course to other employees?



Course Retrospective: Continue, Start, Stop

Course Outline

Tuesday Topic	Instructor	Theme/Takeaway	Wednesday Topic	Instructor	Theme/Takeaway	Thursday Topic	Instructor	Theme/Takeaway
2-Minute Intros	Dr. Glenn Tolentino	Build personal connections with other classmates	Day 1 recap + plan of the day	Dr. Glenn Tolentino	Review of key topics provided the previous day	Day 2 recap + plan of the day	Dr. John Wood	Review of key topics provided the previous day
Admin & Logistics	Dr. Glenn Tolentino	Understand how the course will be ran	Introduction to IEEE Std 15288:2015	Dr. Glenn Tolentino	Understand the scope of IEEE Std 15288	Leadership in a Virtual World	Brenda P. Mangente, PhD	Pick a Leadership Style, Trust, Commit, Practice
Course Overview	Dr. John Wood	Understand the structure of the course	Agreement Processes (Overview)	Dr. John Wood	Become familiar with Agreement Processes	Team Excellence	Ryan Price Alyssa Mroczek	Improving team excellence and leadership excellence
Day 1 Wrap Up	Dr. Glenn Tolentino	Recap of key lessons learned	Organizational Project-Enabling Processes (Overview)	Dr. John Wood	Become familiar with Organizational Project-Enabling Processes	Who is who, in the C2E2 Zoo?	Dr. Shane Riley	Department and division overview.
Engineering Leadership	Dr. John Wood	Highlight the importance of leadership in engineering	Technical Management Processes (Overview)	Dr. John Wood	Become familiar with Technical Management Processes	Application of Design Thinking	Tawnia Gillespie	Applying User Center Design on a Project Task
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The Need for Speed	Dr. John Wood	Create dissatisfaction with current speed to capability and lay foundation for improvements				Integral Piece of Elegant Engineering	Mike Hricko	Design & Development for the warfighter. "slow is steady, steady is smooth, smooth is fast"
The Systems Engineer	Dr. John Wood	Define the role of the Systems Engineer				Division Engineering Discussion	Donna Williamson	Discuss engineering direction and drivers from the B&EIS Division Head
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Can we make
it two and half
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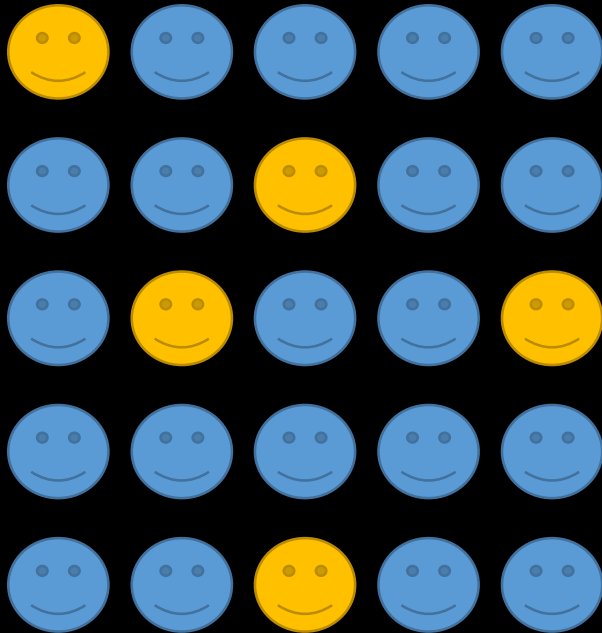
I bet we can!

What?!

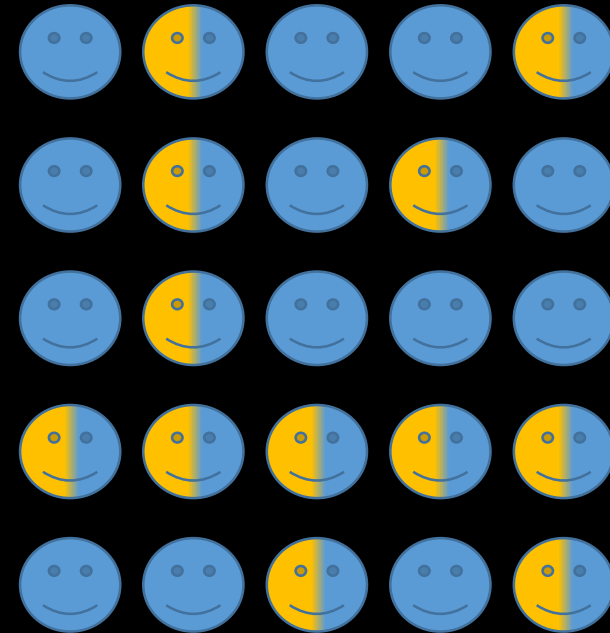
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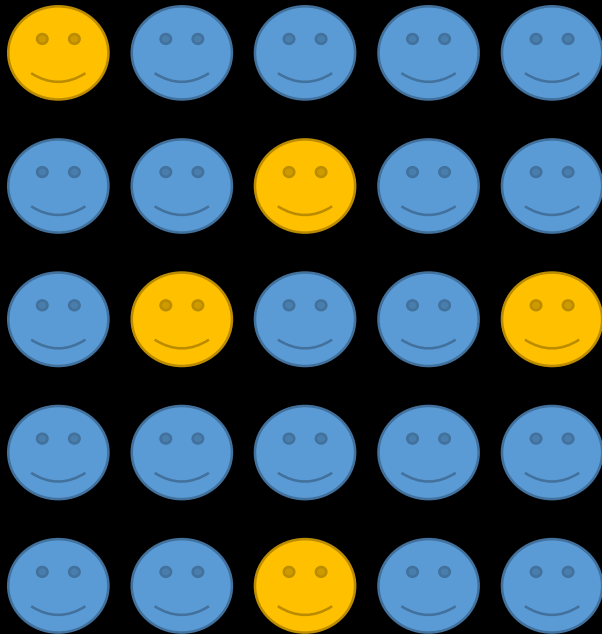
Which would be more powerful?



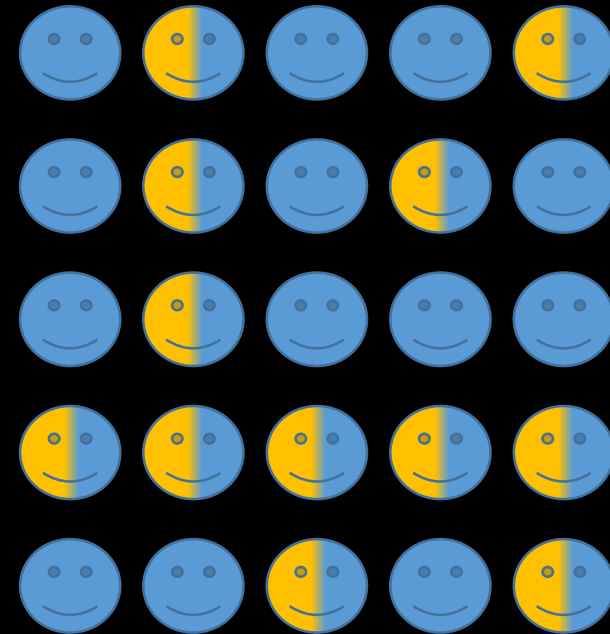
Or



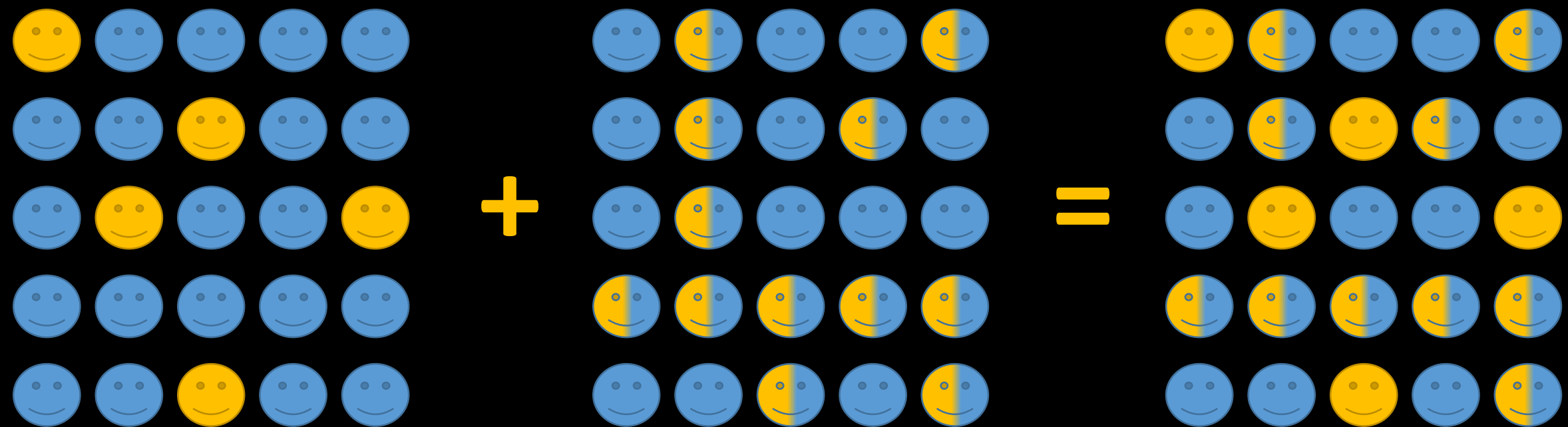
Which would be more powerful?



Or
And!



Which would be more powerful?



Our Goal = Speed to Capability

Well-executed systems engineering
is the fastest path to successful delivery
of capability to the Fleet.

- Missed steps and shortcuts lead to re-starts, re-work, or even Warfighter peril—*These are all avoidable!*
- Over-engineering leads to excessive costs, unnecessary delays, and Warfighters without the capabilities needed to fight and win—*This must also be avoided!*
- Engineers must right-size the approach to performing each technical process to match the rigor required for the system being engineered.

Let's Define our “Minimum Viable Product”

“Minimum Viable Class”

Let’s Define our ~~“Minimum Viable Product”~~

“Minimum Viable Class”

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Students must be able to:

- Define systems engineering
- Identify the dangers of too little or too much systems engineering
- Perform the 14 technical processes contained in IEEE Standard 15288 *Systems and Software Engineering Life Cycle Processes*
- Understand common tools and practices (Agile, DevSecOps, MBSE, etc.) and how they align to the 14 technical processes
- Immediately apply what was learned and produce a positive impact on their current project or work assignment

16 hours removed!

- “Accelerator” Guest Speakers (4.5 hours)
- 2x Lunch Breaks, 6x Short Breaks (3 hours)
- Engineering Leadership (1.5 hours)
- Team Building (1.5 hours)
- Systems Thinking and Causal Loop Diagramming (1.5 hours)
- Detailed content on 2x Agreement Processes, 6x Organizational Project-Enabling Processes, and 8x Technical Management Processes (1.5 hours)
- Systems Engineering Roles (1 hour)
- The Need for Speed (1 hour)
- Daily Recap and Summary (0.5 hours)

Systems Engineering Essentials

Through a combination of instruction and hands-on practical application, this one-day course will help NIWC Pacific engineers sharpen their skills and equip them to lead cross-disciplinary teams that rapidly deliver capability to the Warfighter.

- The Systems Engineer
- The Formula for Success
- Overview of IEEE Standard 15288
Systems and Software Engineering Life Cycle Processes
- Deep Dive into Technical Processes
 - Integrated Practical Application –
The Zombie Project
- Systems Engineering Accelerators
- Applying What You Learned

The Systems Engineer

How to explain SE to kids – Sports Analogy

- The “Coach” of the Engineering Team

How to explain SE to adults– CNN

- They're the "big think" managers on large, complex projects, from major transportation networks to military defense programs. They figure out the technical specifications required and coordinate the efforts of lower-level engineers working on specific aspects of the project.

How to explain SE to fellow techies – INCOSE

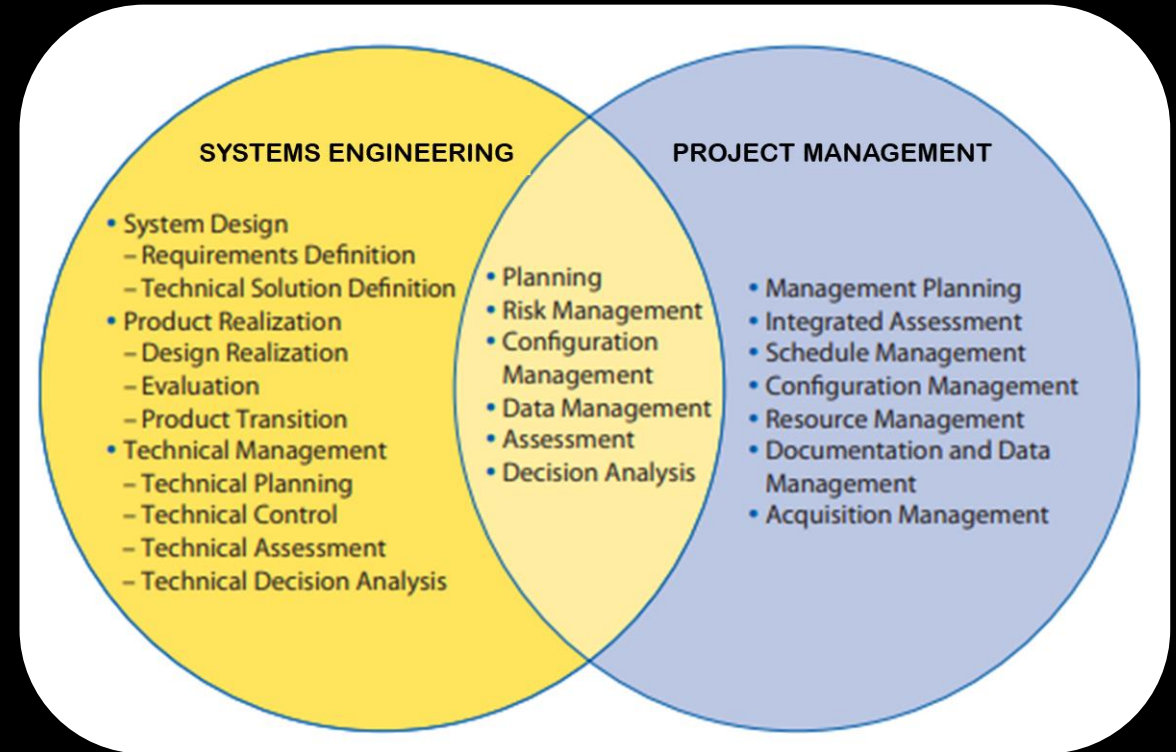
- Systems engineers are at the heart of creating successful new systems. They are responsible for the system concept, architecture, and design. They analyze and manage complexity and risk. They decide how to measure whether the deployed system actually works as intended. They are responsible for a myriad of other facets of system creation.

Systems Engineering

INCOSE Definition

An integrative branch of engineering that concentrates on the total lifecycle (i.e., cradle to grave) of the whole as distinct from the parts. SE processes address the objective in its entirety by considering all the facets and variables including social, business, and technical aspects. “Engineered systems” may be composed of any or all of people, products, services, information, processes, and natural elements.

NASA SE vs. PM



The Formula for Success



The Formula for Success

IEEE Standard 15288 –
*Systems and Software Engineering
Life Cycle Processes*

Foundational
Engineering
Processes



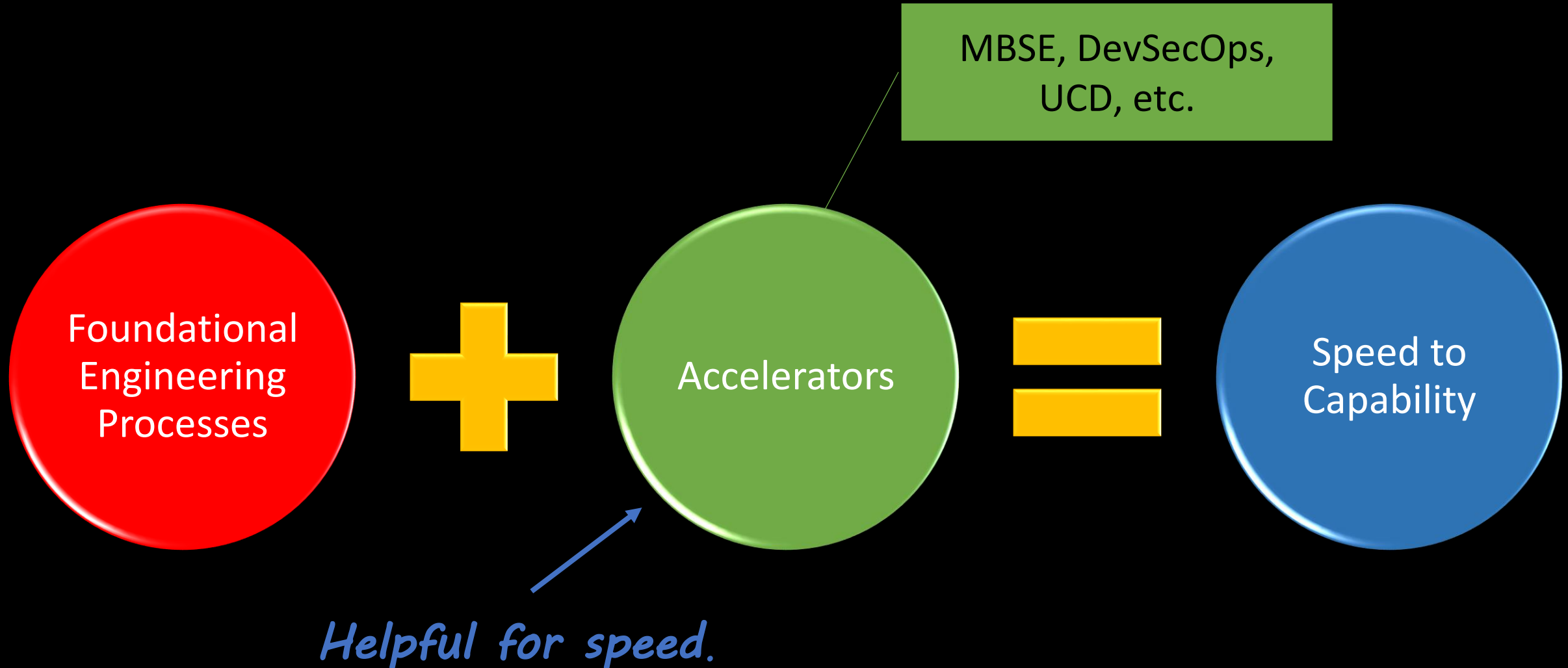
Accelerators



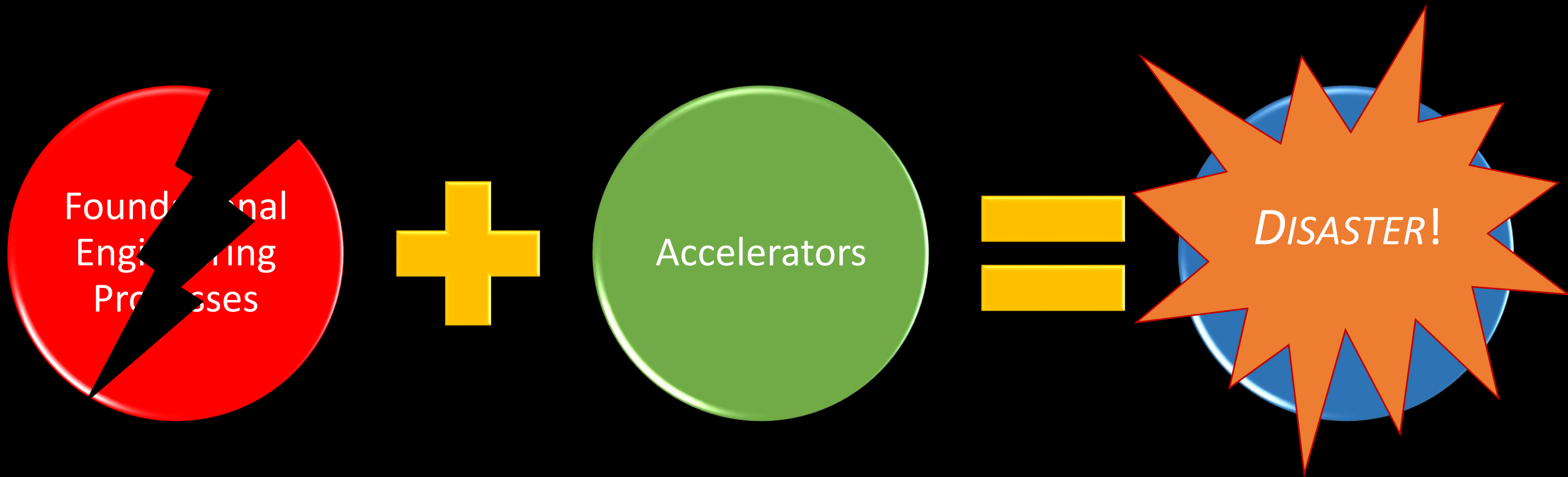
Speed to
Capability

*Necessary for
capability!*

The Formula for Success



The Formula for Success



IEEE Standard 15288 *Systems and Software Engineering Life Cycle Processes*

- Purpose and benefits of a standard
- Purpose statements for:
 - Agreement Process Group (2x)
 - Organizational Project-Enabling Process Group (6x)
 - Technical Management Process Group (8x)
- Purpose statements, outcomes, and activities for:
 - Technical Processes (14x)

Integrated Practical Application: The Zombie Project

Your city has recently been overrun by zombies. The Director of Public Transportation asked you and your team to develop a travel system that will keep the public safe from the zombies.

Technical Processes and The Zombie Project

Section	Process	Project
6.4.1	Business or Mission Analysis Process	Zombie Project – Part 1 (30 min)
6.4.2	Stakeholder Needs and Requirements Definition Process	
6.4.3	System Requirements Definition Process	
6.4.4	Architecture Definition Process	Zombie Project – Part 2 (30 min)
6.4.5	Design Definition Process	
6.4.6	System Analysis Process	
6.4.7	Implementation Process	Zombie Project – Part 3 (20 min)
6.4.8	Integration Process	
6.4.9	Verification Process	Zombie Project – Part 4 (30 min)
6.4.10	Transition Process	
6.4.11	Validation Process	
6.4.12	Operation Process	Zombie Project – Part 5 (30 min)
6.4.13	Maintenance Process	
6.4.14	Disposal Process	
N/A	Retrospective – What did you learn during the Zombie Project?	

Systems Engineering Accelerators

- DevOps and DevSecOps
- Agile, Scrum, and Kanban
- Iterative and Incremental
- Continuous Integration, Continuous Delivery, and Continuous Deployment
- Model-Based Systems Engineering, Models and Simulation
- User-Centered Design
- NIWC Pacific Digital Engineering Launch Pad

Accelerator to Technical Process Mapping

Section	Process	DevSecOps	Agile	Cont. Integration	Cont. Delivery	Cont. Deployment	Model-Based Systems Engineering	User- Centered Design
6.4.1	Business or Mission Analysis Process							
6.4.2	Stakeholder Needs and Requirements Definition Process						A/M	M
6.4.3	System Requirements Definition Process						A/M	
6.4.4	Architecture Definition Process						M	
6.4.5	Design Definition Process	M	M				M	M
6.4.6	System Analysis Process						A	
6.4.7	Implementation Process	M	M					
6.4.8	Integration Process	A		A				
6.4.9	Verification Process	A		A	A	A	A/M	
6.4.10	Transition Process	A			M	A		
6.4.11	Validation Process	M	M				M	M
6.4.12	Operation Process							
6.4.13	Maintenance Process							
6.4.14	Disposal Process							

A = Automated, M = Manual, A/M = Automated or Manual

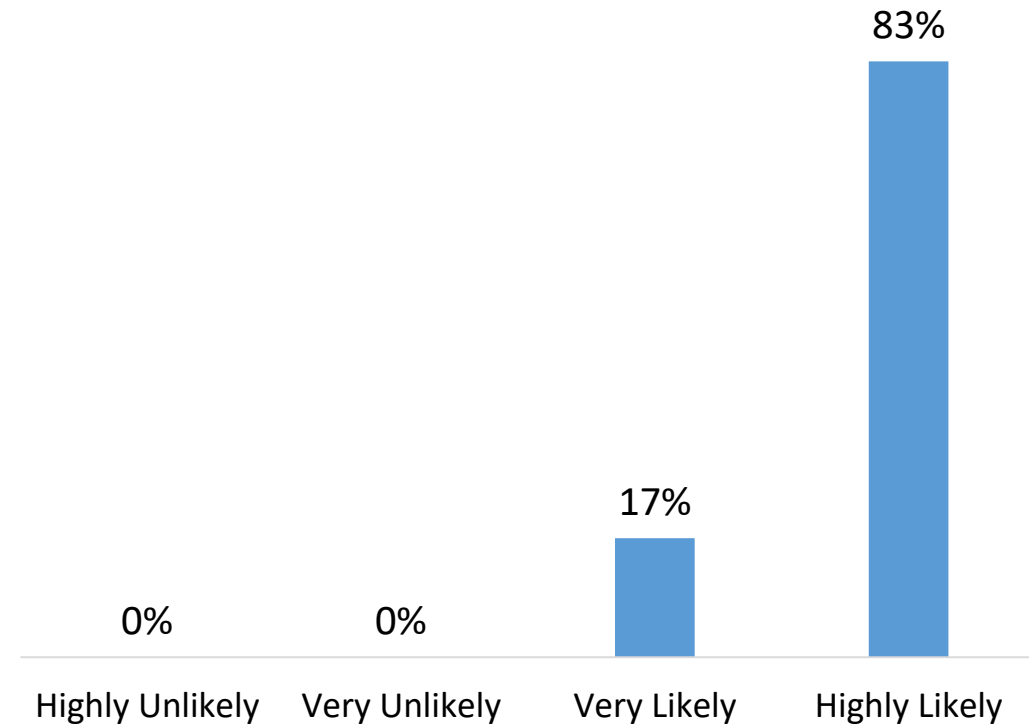
Applying What You Learned

- Work with one or more teammates on your project to complete the Systems Engineering Exploration Worksheet within the next two weeks.
- Limiting yourself to 60-90 minutes, complete the worksheet in a similar manner to how you completed the Zombie Project slides, BUT do it from the perspective of your project (not the zombie perspective).
- Document key insights you and your teammate(s) gained by going through the exercise.
- Email the completed worksheet to the course instructors.

Survey Says...

- If you're not sure what a system engineer does, this is the class to take.
- The instructors were very knowledgeable and the content valuable.
- Zombie exercises really helped us conceptualize the concepts.
- Provide samples rather than having students assume.
- I think this course should be taught to logistics and process engineers. They would benefit too.
- I really enjoyed the class and learned a lot.

How likely are you to recommend this course to other employees?



Insights from Instructors

- Maximum of 10 students broken into 2 groups for the practical application is optimal for learning and schedule
- Two instructors are optimal to teach all of the areas in sharing their diverse experiences, course workload, and course management
- If teaching remote, each instructor should be on a separate VPN and also ensure each instructor has all course material in case of technical difficulties
- Strict adherence to schedule is required to complete in 9 hours, including a 1 hour lunch break and two 15 minute breaks

Course Retrospective: Continue, Start, Stop

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Here we go
again!

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hour?

Systems Engineering Essentials

Through a combination of instruction and hands-on practical application, this one-day course will help NIWC Pacific engineers sharpen their skills and equip them to lead cross-disciplinary teams that rapidly deliver capability to the Warfighter.

- The Systems Engineer
- The Formula for Success
- Overview of IEEE Standard 15288 *Systems and Software Engineering Life Cycle Processes*
- Deep Dive into Technical Processes
 - Integrated Practical Application – The Zombie Project
- Systems Engineering Accelerators
- Applying What You Learned

Here we go
again!

To be continued...

**BRINGING THE POWER OF
INFORMATION TO THE FIGHT!**

***Naval Information
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