33rd Annual **INCOSE** international symposium

hybrid event
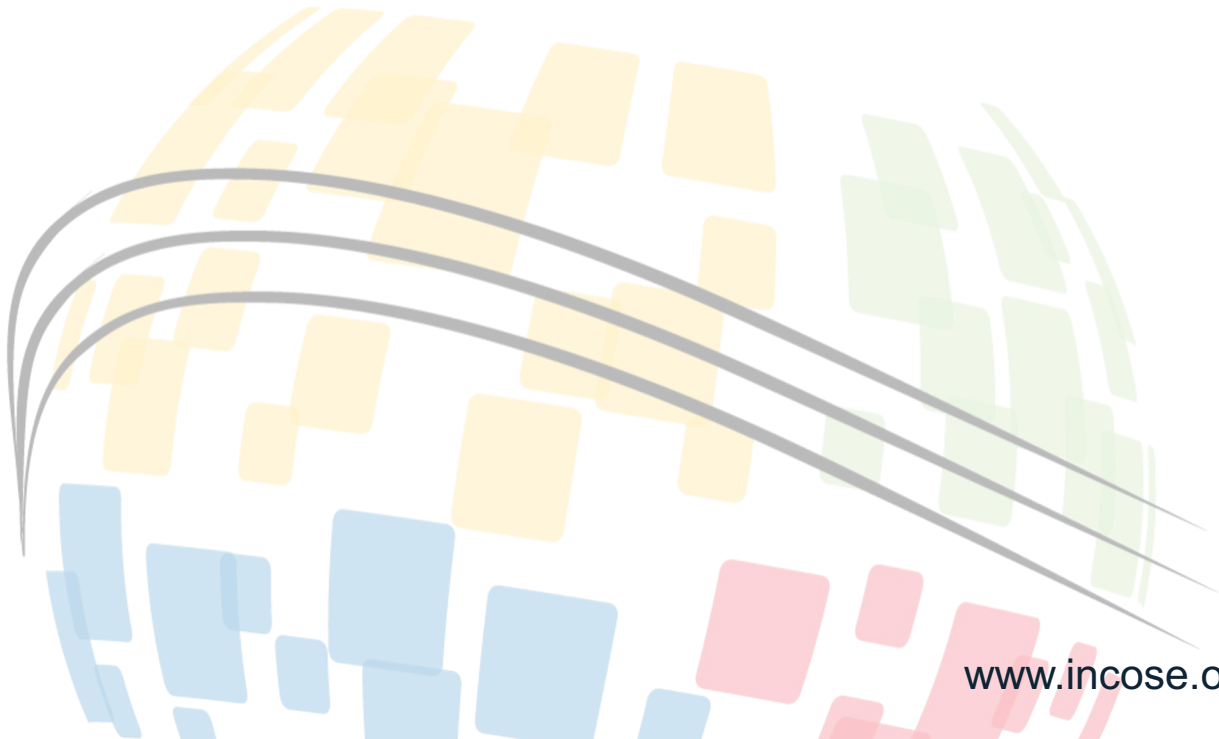
Honolulu, HI, USA
July 15 - 20, 2023

Systems Engineering Technology:

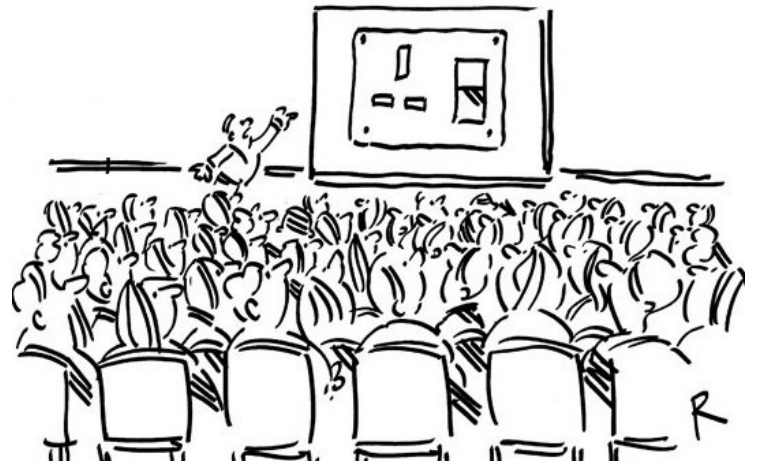Closing the MBSE Modeling Gap through Community College

Chris M. Crumbly, Executive Director
Susan Askew, Subject Matter Expert
Institute for Digital Enterprise Advancement
www.idea-set.org

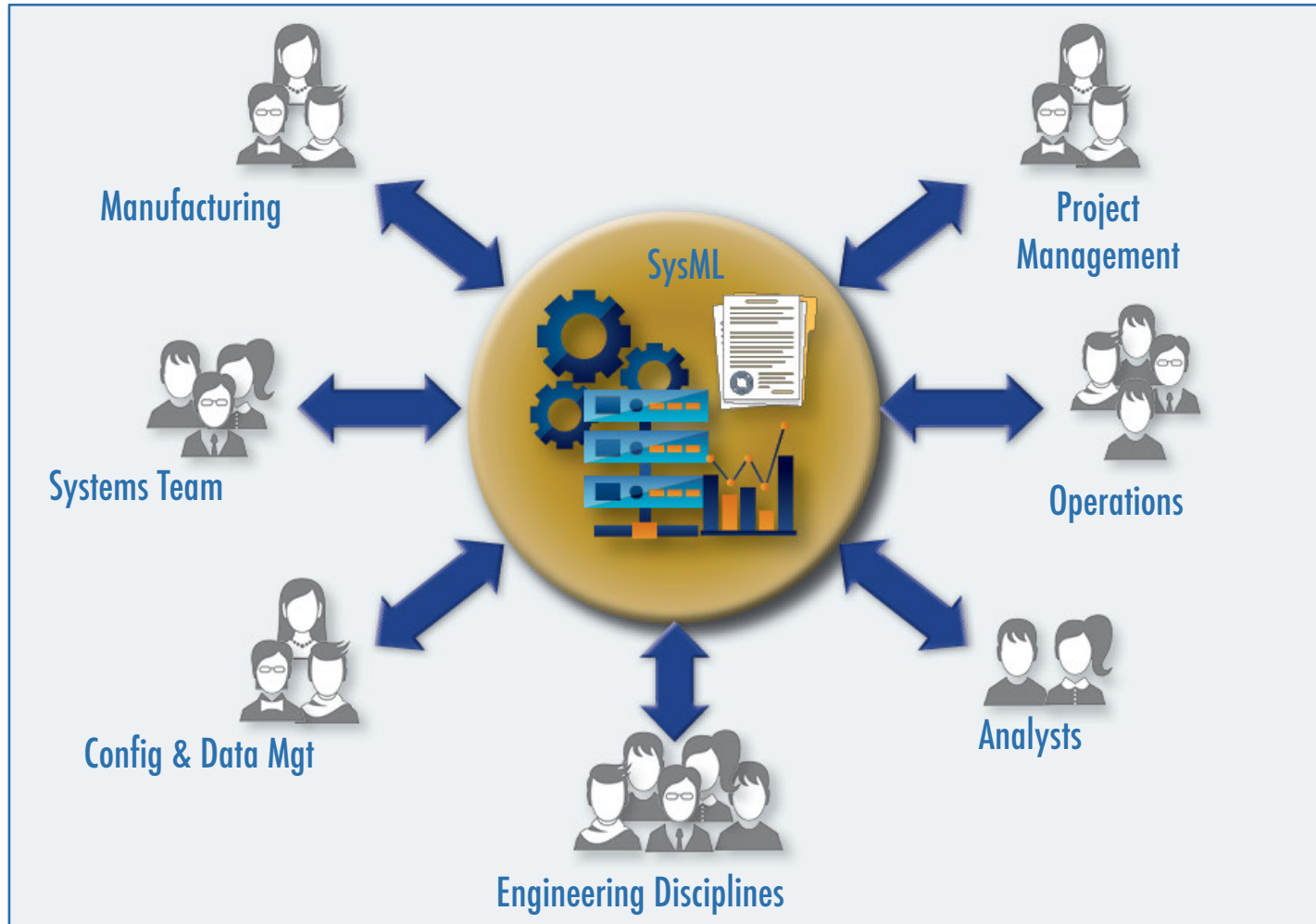# Model-Based Systems Engineering (MBSE) remains a mystery to many organizations

The Systems Engineer's Environment (Document Based)

The Systems Engineer's Environment (Model-Based)

- Manufacturing
- Systems Team
- Config & Data Mgt
- SysML
- Project Management
- Operations
- Analysts
- Engineering Disciplines

1. **Ensure the product satisfies the Customer and Stakeholders**
2. **Optimize the system and facilitate compromise**
3. *Connect the product and organizational parts, find the gaps*
4. *Reduce the confusion and risk caused by complexity*

Systems Engineering Technology (SET) Solution

Problem Statement

MBSE shortens the DDT&E life-cycle but the *supply* of practitioners does not meet the workforce *demand*

USG Industrial Base Investment
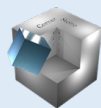
CORNERSTONE
Cornerstone of the American Military competitive edge

Auburn University

Academic Partners

CALHOUN COMMUNITY COLLEGE

VictorySolutions
Industry Partner

SET
SYSTEMS ENGINEERING TECHNOLOGY

INSTITUTE FOR DIGITAL ENTERPRISE ADVANCEMENT

Nonprofit Partner

The SET Approach

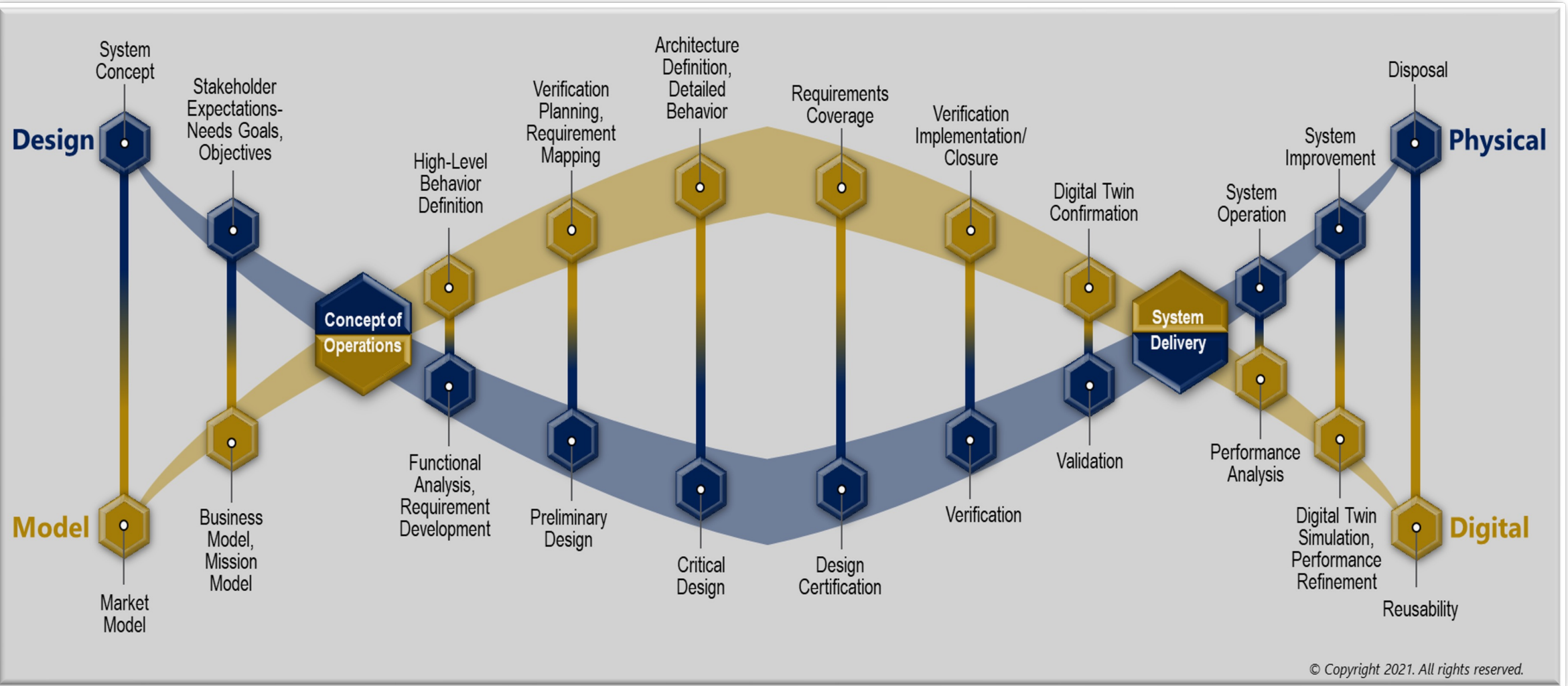Develop a *Systems Engineering Technology* degree modeled after the CAD Technician 2-year degree

Plan of Action

- Implement the pathfinder SET curriculum at Calhoun (8/21)
- Deploy SET in DDT&E communities across the nation
- Move upstream to high schools and downstream to universities
- Provide professional instruction to practicing engineers

IDEA MBSE Helix for Instruction
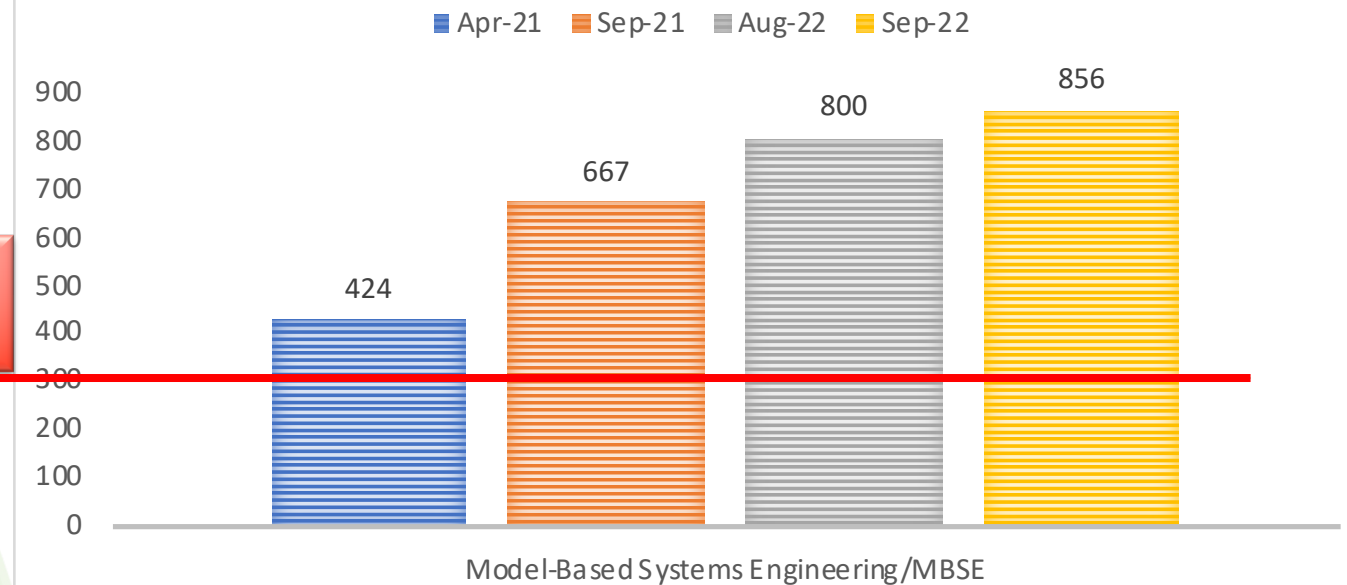
Filling the MBSE Gap

Universities are not meeting regional demand for MBSE practitioners

Key Aerospace and Defense Organizations in Huntsville, AL
- NASA
- US Army Missiles and Space
- US Army Aviation
- US Army Material Command
- Missile Defense Agency
- Boeing
- Lockheed Martin
- Aerojet Rocketdyne
- L3 Harris
- Ratheon
- More than 300 A&D companies

>$160B in Federal Funds Annually

163 SE Degrees conferred in 2021 across all Alabama schools

INDEED.COM JOB POSTINGS IN HUNTSVILLE, AL

■ Apr-21　■ Sep-21　■ Aug-22　■ Sep-22

	Apr-21	Sep-21	Aug-22	Sep-22
Postings	424	667	800	856

Model-Based Systems Engineering/MBSE

SET enrollment reached 44 students in 4 semesters—at one school alone

www.incose.org/symp2023

7

Digital Transformation is Coming to a City Near You

MBSE Job Postings April 2023 (indeed.com)

Eglin AFB, FL — 100

1500 — Los Angeles, CA

Dayton, OH — 200

1100 — Seattle, WA

Range of Educational Opportunities - IDEA

Associate Degree for Systems Modelers (or short certificate)
- Associate of Applied Science Degree in Systems Engineering Technology-
- Student internships/Apprenticeship with MBSE implementing organizations to provide real experience

Associate Degree

Professional Education Courses
- Short course in MBSE implementation, benefits, implications, and costs (8 hours)
- Short course in MBSE familiarization and relationships with other project functions (40 hours)

Professional Education

System Engineering Certificate Demonstrating MBSE Competency
- Certificate Programs Currently Under Development
- Semester-length course leading to a certificate demonstrating modeling competency

Certificate

University-Level Electives and/or Short-term Certificates
- Industrial and Systems Engineering Elective
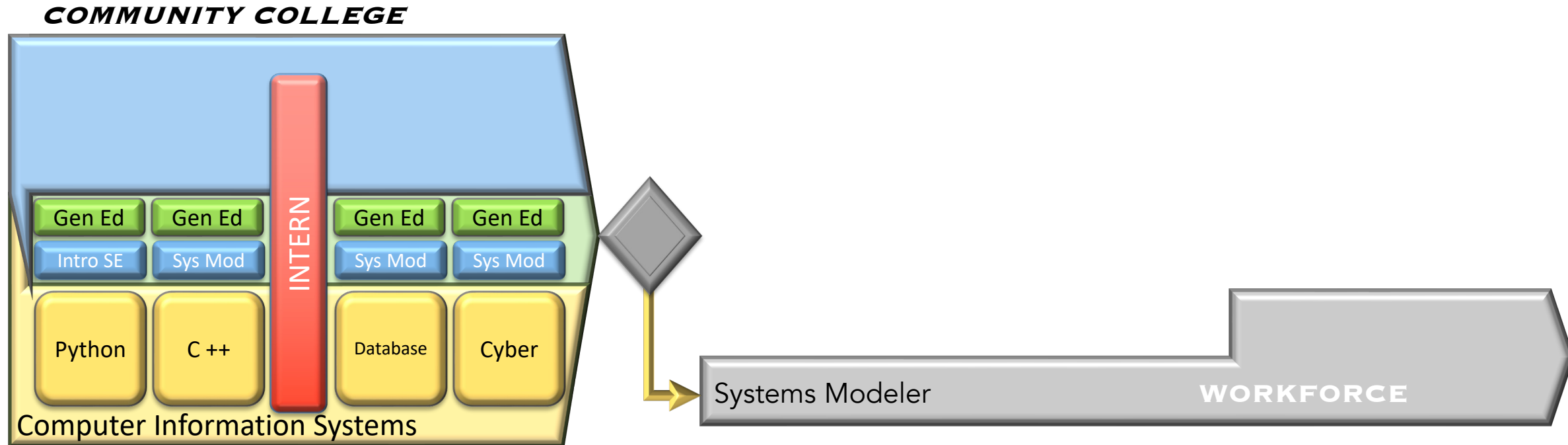- Add-on Certificates for Modeling

University Level
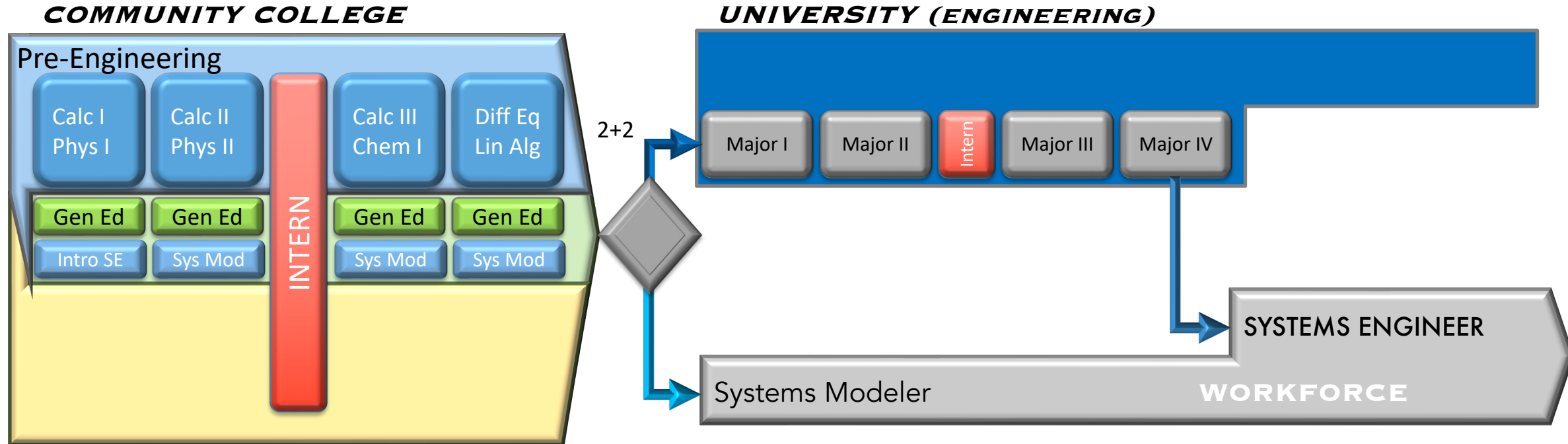
High School and Middle School Modules
- Introduce system engineering concepts early
- Provide alternate pathway for STEM career
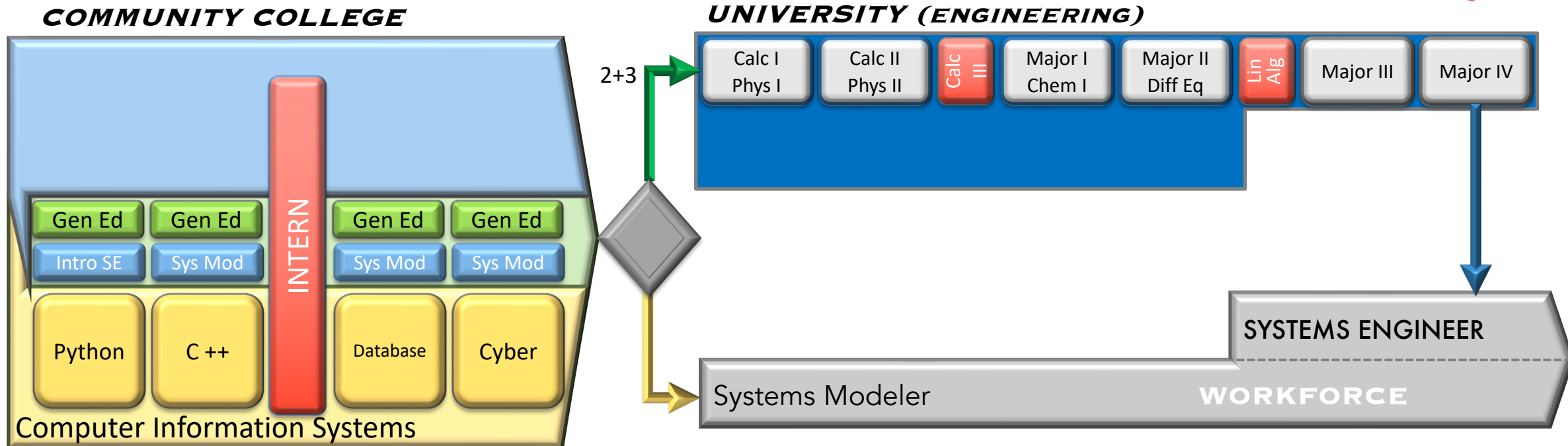
Secondary Education

Computer Information Systems:
SET Concentration
(Pathway 1)

Pre-Engineering:
SET Concentration
(Pathway 2)

COMMUNITY COLLEGE

UNIVERSITY (ENGINEERING)

Pre-Engineering

| Calc I Phys I | Calc II Phys II | | Calc III Chem I | Diff Eq Lin Alg |

INTERN

| Gen Ed | Gen Ed | Gen Ed | Gen Ed |
| Intro SE | Sys Mod | Sys Mod | Sys Mod |

2+2

| Major I | Major II | Intern | Major III | Major IV |

SYSTEMS ENGINEER

Systems Modeler

WORKFORCE

Computer Information Systems: SET Concentration, then University (Pathway 3)

3 MBSE Workforce Pathways

COMMUNITY COLLEGE

Pre-Engineering

| Calc I Phys I | Calc II Phys II | INTERN | Calc III Chem I | Diff Eq Lin Alg |

| Gen Ed | Gen Ed | Gen Ed | Gen Ed |
| Intro SE | Sys Mod | Sys Mod | Sys Mod |

| Python | C ++ | Database | Cyber |

Computer Information Systems

UNIVERSITY (ENGINEERING)

| Calc I Phys I | Calc II Phys II | Calc III | Major I Chem I | Major II Diff Eq | Lin Alg | Major III | Major IV |
| Major I | Major II | Intern | Major III | Major IV | | | |

2+3

2+2

2

Pathway 1

2+2
Pathway 2

2+3
Pathway 3

SYSTEMS ENGINEER

Systems Modeler

WORKFORCE

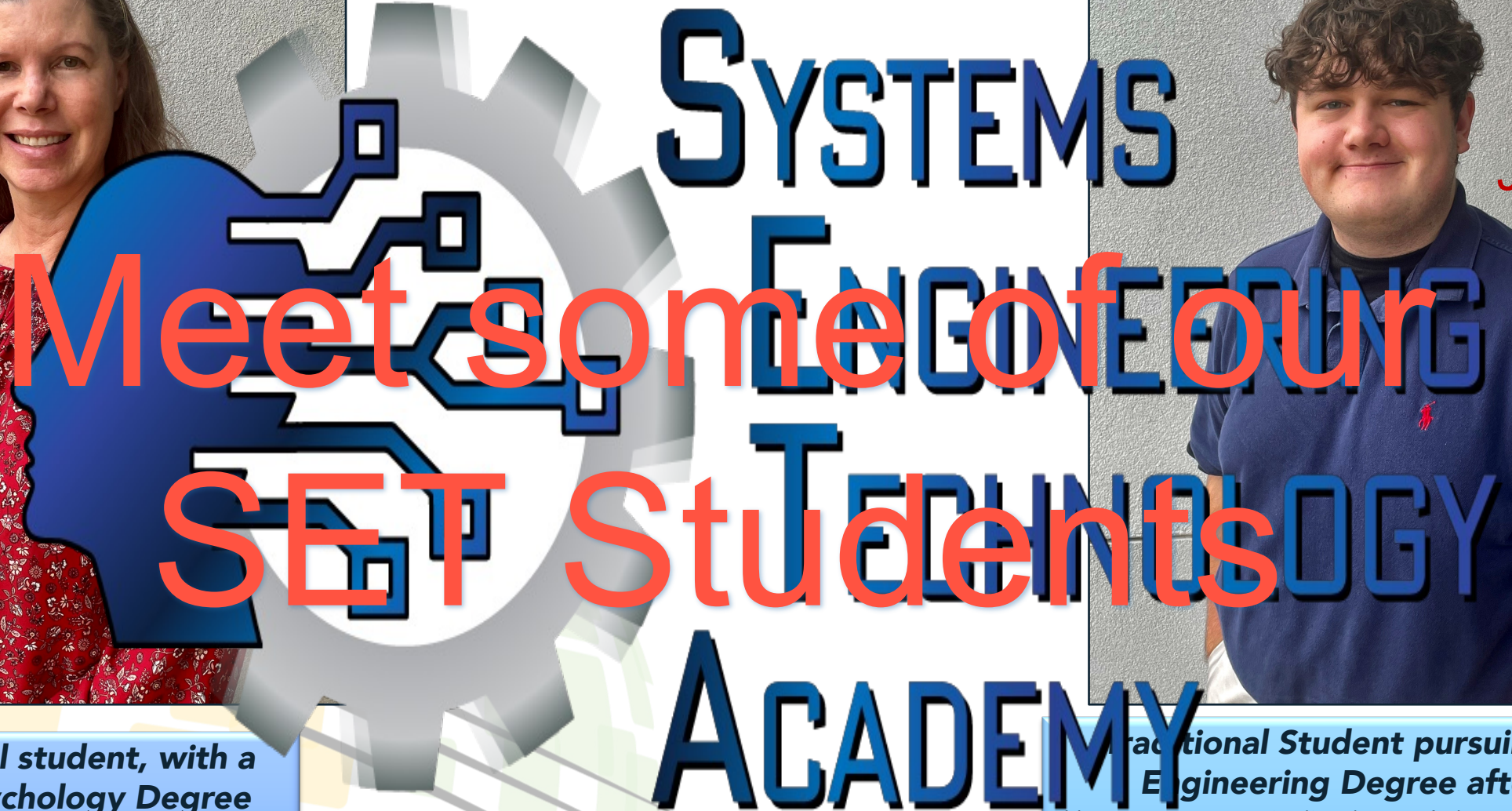| **Systems Engineering Technology Courses**		
SYS 101: Intro to Systems Engineering	SYS 231: Systems Modeling I	SYS 233: Systems Modeling III
SYS 221: MBSE in the Digital Environment	SYS 232: Systems Modeling II	SYS 241: SET Capstone

Meet some of our SET Students

Linda

Jackson

Systems Engineering Technology Academy

Nontraditional student, with a Master of Psychology Degree

The opportunity to apply my classroom skills in the workforce is incredibly valuable. In addition to building my resume with new programming skills, exposure to the workplace environment reinforces the classroom curriculum.

Traditional Student pursuing a 2+3 Engineering Degree after SET

I have an opportunity lined up at Auburn University that allows me to get a bachelor's degree in systems and industrial engineering and possibly a master's in the same thing at the same time...My skills-based SET experience will give me a unique perspective and ability to contribute to classes.
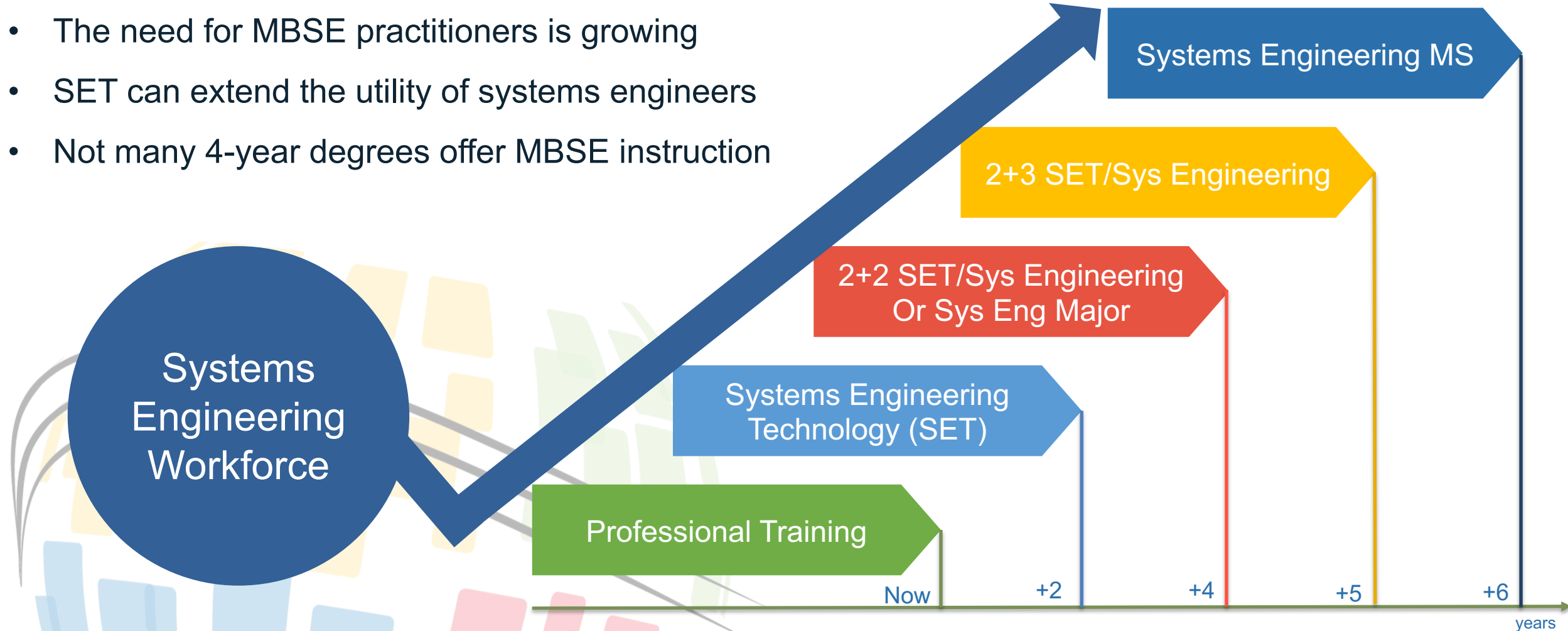
Sustainment Through the SET Academy
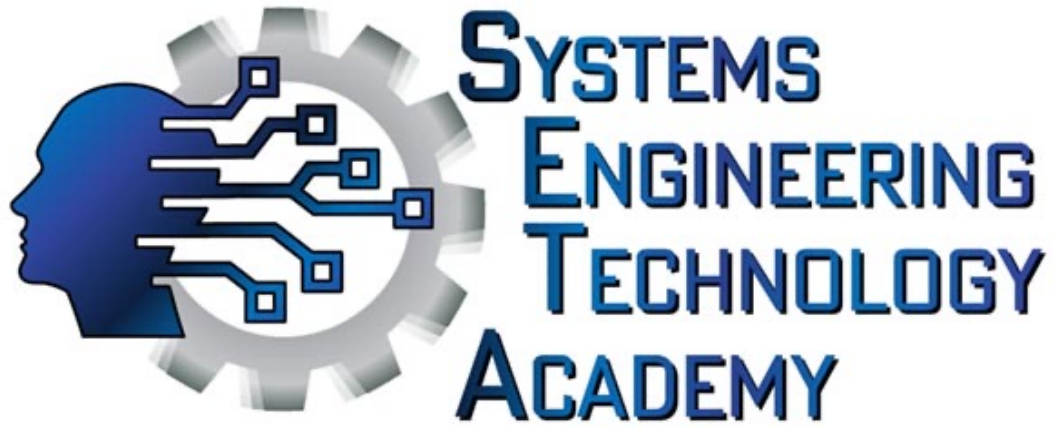
- *SET course content (plug and play)*
  - *Blackboard*
  - *Canvas*
- *Train the trainer programs*
- *Professional Education Programs (noncredit)*
- *Adjunct instructor sourcing*
- *Ongoing support from IDEA*
- *Continuous updates as MBSE tools mature*

SET Accelerates MBSE Acceptance

- The need for MBSE practitioners is growing

- SET can extend the utility of systems engineers

- Not many 4-year degrees offer MBSE instruction

Systems Engineering Workforce

Systems Engineering MS

2+3 SET/Sys Engineering

2+2 SET/Sys Engineering Or Sys Eng Major

Systems Engineering Technology (SET)

Professional Training

Now   +2   +4   +5   +6

years

Questions

Use this QR code for more information on SET

Or this link: https://idea-set.org/

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hybrid event

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