



28th Annual **INCOSE**
international symposium

Washington, DC, USA
July 7 - 12, 2018

Systems Engineering and Society

SE Needs Recognition from the General Public to Become Universally
Appreciated

Stephen J. Sutton, PE, ESEP
stephen.sutton@incose.org



Who Am I?

- ESEP: 50 years experience in telecommunications, information, and intelligence systems
- Lead SE, PM, line manager, director of SE education program
- Active in INCOSE
 - INCOSE Liaison to ABET and a PEV
 - PM for INCOSE IT Revamp
 - Past President of Chesapeake Chapter
 - Member Board
 - CAB



Systems Thinking and Systems Engineering Are Not New



Pompeii
Street
79 c.e.



Author's photos



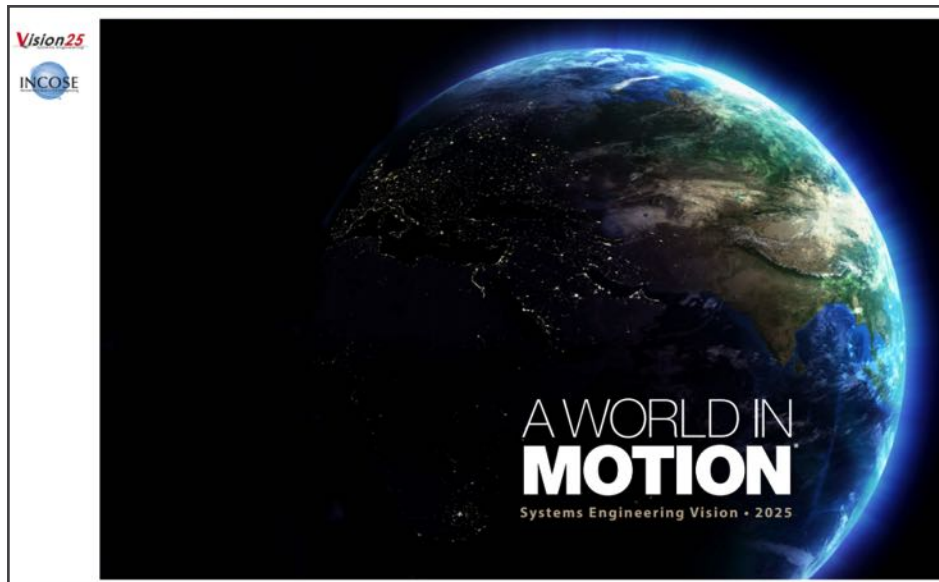
Mesa Verde National Park
Ancestral Puebloan Cliff
Dwellings Circa 1190 c.e.



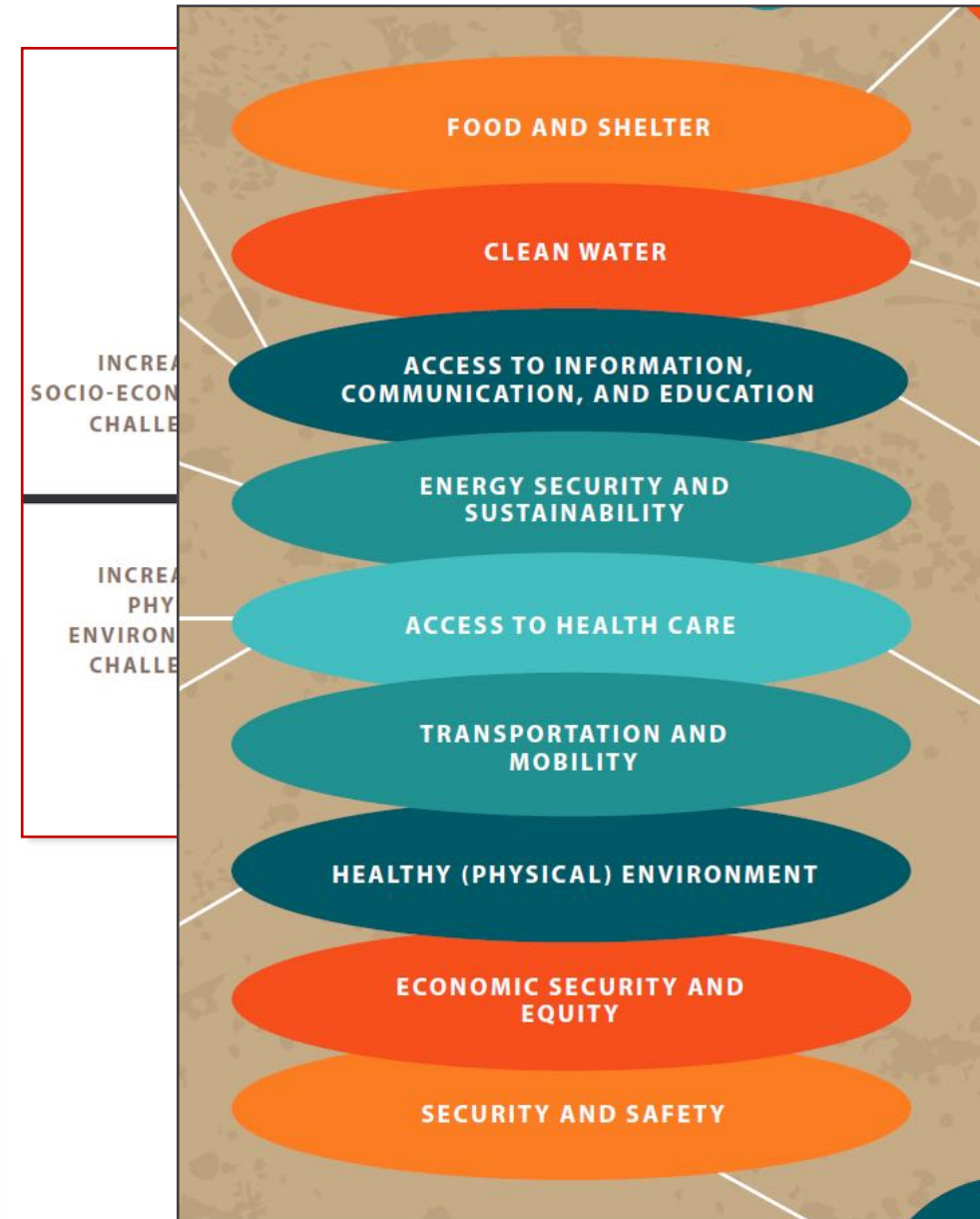
da Vinci Water Wheel 1478-1518
<https://www.mos.org/leonardo/inventor>

Why SE and Society?

- Passion for SE
- SE Vision 2025
- Achieving the Vision



Images from Systems Engineering Vision 2025, INCOSE





Toward Achieving the Vision

- Improve Strategy for The Future for Systems Engineering
- Influence Engineering and SE education
- Fill a Gap to Achieve the Future for SE

The Future for Systems Engineering

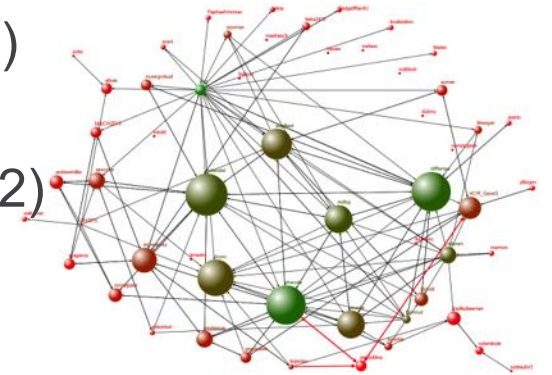
(p23-49)

- Broadening Systems Engineering Application Domains
- Transforming Systems Engineering
- Systems Engineering Foundations
- Roles and Competencies
- Education and Training

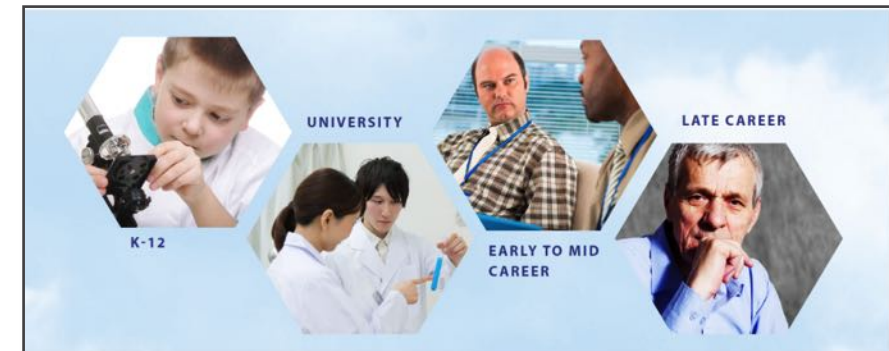
“Formal systems approach helps decision-makers to select **cost effective, safe, and sustainable policies** that are more broadly embraced by the stakeholder community.” (p26, author emphasis)



“Leveraging Value from Pieces” (p32)



“Life Long SE Education and Training” (p45)



Influence Engineering and SE Education

A screenshot of the ABET Accreditation website. The browser address bar shows 'www.abet.org/accreditation/'. The website has a white header with the ABET logo and navigation links: 'ABOUT ABET', 'FIND AN ABET-ACCREDITED PROGRAM', 'MYABET LOGIN', 'TRAINING', 'UPCOMING EVENTS', 'ABET NEWS', and a 'SITE SEARCH' box. Below the header is a dark navigation bar with 'ACCREDITATION' (highlighted in orange), 'A NETWORK OF EXPERTS', 'WORKSHOPS & EVENTS', and 'GLOBAL PRESENCE'. A 'MENU' button is on the right. The main content area features a large image of a dam with the word 'ACCREDITATION' overlaid in white. Below this is an orange box with the text 'SETTING THE STANDARD WORLDWIDE' and a downward arrow icon. To the right of this box are five links: 'REQUEST FOR EVALUATION (RFE)', 'WHY ACCREDITATION MATTERS', 'NEW TO ACCREDITATION?', 'GET ACCREDITED', and 'ACCREDITATION CRITERIA'. The bottom of the orange box contains text about ABET's role as a nonprofit accrediting agency and its standards for engineering programs.

Washington DC News, Marylan... Accreditation | ABET

www.abet.org/accreditation/

tion of blood banks →

ABET

ABOUT ABET | FIND AN ABET-ACCREDITED PROGRAM | MYABET LOGIN | TRAINING | UPCOMING EVENTS | ABET NEWS | SITE SEARCH

ACCREDITATION | A NETWORK OF EXPERTS | WORKSHOPS & EVENTS | GLOBAL PRESENCE

MENU

ACCREDITATION

SETTING THE STANDARD WORLDWIDE

We are a nonprofit, non-governmental accrediting agency for programs in applied and natural science, computing, engineering and engineering technology and we are recognized as an accreditor by the Council for Higher Education Accreditation.

ABET accreditation provides assurance that a college or university program meets the quality standards of the profession for which that program prepares graduates.

We accredit programs, not institutions. We provide specialized accreditation for post-secondary programs within degree-granting institutions already recognized by national or regional institutional accreditation agencies or national education authorities worldwide.

Our accreditation is voluntary, and to date, over 3,800 programs at

REQUEST FOR EVALUATION (RFE)

WHY ACCREDITATION MATTERS

NEW TO ACCREDITATION?

GET ACCREDITED

ACCREDITATION CRITERIA

Influence Engineering and SE Education:

ABET(www.abet.org)



- 86 years / 35 member societies
 - **3852** programs: **776** institutions; **31** countries
 - **2671** engineering programs: **548** institutions
 - **531** eng'g programs: **114** institutions outside of US
 - 4-6 year re-accredit cycle
- INCOSE a member of ABET
 - ABET accredits college and university **programs** in the disciplines of applied science, computing, engineering, and engineering technology at the associate, bachelor, and master degree levels in/outside of US.
 - **Voluntary**
 - Impartial, **peer-to-peer** approach; outcomes based
 - Continuous quality improvement
 - INCOSE, IEEE, IIE, ASME, ISA, CSAB, SAE co-lead for SE programs

Influence Engineering and SE Education:

ABET(www.abet.org)



- **General Criteria for Baccalaureate Level Engineering Programs – outcomes based**
 - Students
 - Program Educational Objectives
 - **Student Outcomes**
 - Continuous Improvement
 - **Curriculum**
 - Faculty
 - Facilities
 - Institutional Support

Must satisfy all criteria

Encourages Innovation
- **Program Criteria for Specific Engineering Programs (e.g., EE, ME)**

- Provide Program Evaluators
- **Contribute to General Criteria***
- Encourage programs to consider accreditation (Bachelors and Masters)
- **To develop specific criteria for SE***
- Influence future of SE education



The Gap to Achieving the Future

“Having to reconcile the supposedly scientific insights of economics with political and bureaucratic realities proved more challenging than Blanchard had anticipated. What he found most surprising, he said, ***was how quickly a consensus can develop around some questions on the basis of what decision-makers read in the press or hear over dinner.***” *

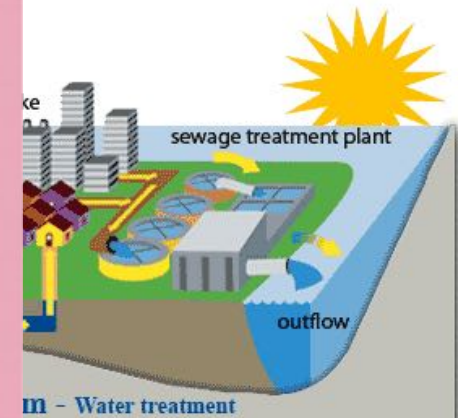
Pearlstein, Steven, Raising Keynes, Business Section, Washington Post, October 4, 2015, p G1 (a profile of retired IMF Chief Economist Olivier Blanchard) **Emphasis is mine*

What is Systems Engineering?



"So often in life,
things that you regard
as an impediment
turn out to be great,
good fortune."

RUTH BADER GINSBURG



(source: image adapted from gov.ab.ca)



- to fulfill public then unders society and Ma
- “I’m a very strong believer in listening and learning from others.”
- Astronaut is ub
- “Look up at the stars and not down at your feet. Try to make sense of what you see, and wonder about what makes the universe exist. Be curious.”
- Create a meme for SE and its practitioners

Knowing About Systems Engineering Allows Systems Engineers to Help Policy



International Policy Issue

- **Migratory Bird Treaty**
- Tariffs and free trade
- Recycling plastic waste

US National Policy Issues

- Food safety
- Pandemic response
- **Autonomous vehicles (cars and drones)**
- Dodd-Frank law (ensuring financial institutions stay solvent)

- Reducing inequality in the US

Local Policy Issues

- Bus vehicle policy
- Policy
- Caring for minor children

Opening a new high school

Helping Non-profits and Charities

- Making objective choices

Public policy in the news leads to considering how to apply SE and systems thinking and can demonstrate value to the general public.

Public policy in the news leads to considering how to apply SE and systems thinking and can demonstrate value to the general public.



Siting a New High School (a system)

- New high school alters local community (a system change)
- Design vs community relationships
- How to integrate design implementation, operation with the community?





Migratory Bird Treaty Act of 1918

- Compliance with MBT
- US-Canada, US-Mexico, US-Japan, US-Russia
- Prohibits the taking or killing of species
- Previously potential prosecution for any killing of species
- Revised opinion is that law does not apply to incidental killing of species – solely economic basis



<https://www.audubon.org/field-guide/bird/eastern-bluebird>

Autonomous Vehicles



- How will autonomous vehicles impact urban areas?
- Need for a **holistic** view to ensure the policy of integrating autonomous vehicles provides benefits for all



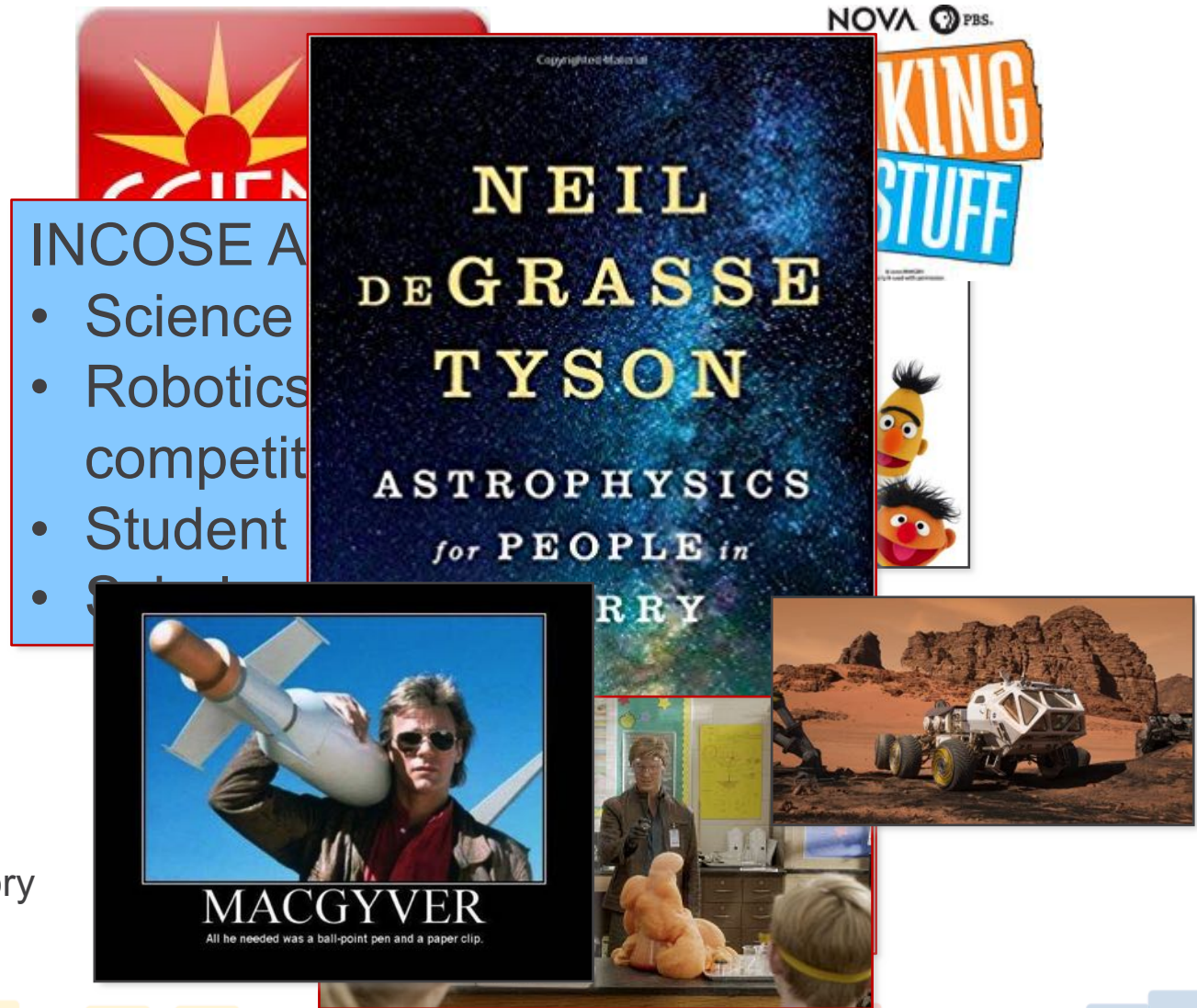
https://www.google.com/search?q=autonomous+vehicle+images&client=firefox-b-1&tbm=isch&source=iu&ictx=1&fir=H40OdTqI6ljABM%253A%252C2tsOeJqAHZ1SvM%252C__&usg=__2YwfD7JRaZYzhqpS07GZNsD9MEw%3D&sa=X&ved=0ahUKEwjC1_XrnZrbAhVNwFkKHTjTDIwQ9QEILzAC#imgsrc=CwbV0-Tyl3WsUM: Image may be subject to copyright

How to Bring SE to the Forefront: Establish the Meme



Making the public more aware:

1. National Media
 1. NPR – Science Friday
 2. NOVA
 3. Science Channel
 4. Sesame Street
 5. Media PSAs
2. SE Month or Week
3. Podcasts
4. Every SE an ambassador for the discipline
5. Original Entertainment
 1. Novel, screenplay
 2. Book that popularizes SE for general reader
 3. Create an SE equivalent of the Big Bang Theory
 4. Revise MacGyver as an SE
 5. Revise Bill Nye as the SE guy



How to Bring SE to the Forefront: Establish the Meme



Influencing/advising executive/legislative branches at all levels – formally and informally via personal networks

1. Lobby staffers
2. Voluntary service
3. Expert testimony
4. Partner with National Academy of Engineering



Integrating with INCOSE Infrastructure



- Create a think tank in collaboration with the INCOSE Foundation:
INCOSE Institute for Applying SE for Public Policy – a advisory arm of INCOSE to “market” systems engineering and help governments and schools of public policy address complex problems: e.g., pandemic responses, mass transportation, teaching of SE principles in K-12
- Enlist other societies like ISA, IEEE, IISE that understand the value of systems thinking and the application of engineering principles to societal issues
- Provide INCOSE Government Fellowships for qualified members to serve as advisors to government legislatures and executive departments



Your Part

- Read the *SE Vision 2025*
- Envision in your mind what it's like to be an SE and the role SE plays in 2025
- Describe your path to the future and start a dialogue within the chapter and beyond – Consider the activities just discussed
- Influence INCOSE to achieve what you envision
- Influence SE Education:
 - Become an INCOSE Program Evaluator
 - Advise a systems engineering program
 - Mentor systems engineering students
 - Advise school systems on curricula for elementary and high schools



The Whole is Greater Than Its Parts

“And he [George Pocock, master shell builder] came to understand how those almost mystical bonds of trust and affection, if nurtured correctly, might lift a crew above the ordinary sphere, transport it to a place where nine boys somehow became one thing – a thing that could not quite be defined, and the earth and the sky above that, as they rowed, effort was replaced by ecstasy.”

Brown, Daniel James, *The Boys in the Boat: Nine Americans and Their Epic Quest for Gold at the 1936 Berlin Olympics*, 2014, Kindle Edition Version_6, Penguin Books, p48



28th Annual **INCOSE**
international symposium

Washington, DC, USA
July 7 - 12, 2018

www.incose.org/symp2018