



33rd Annual **INCOSE**
international symposium

hybrid event

Honolulu, HI, USA
July 15 - 20, 2023



Bringing a Knife to a Gun Fight: Systems Engineering for the Modern World

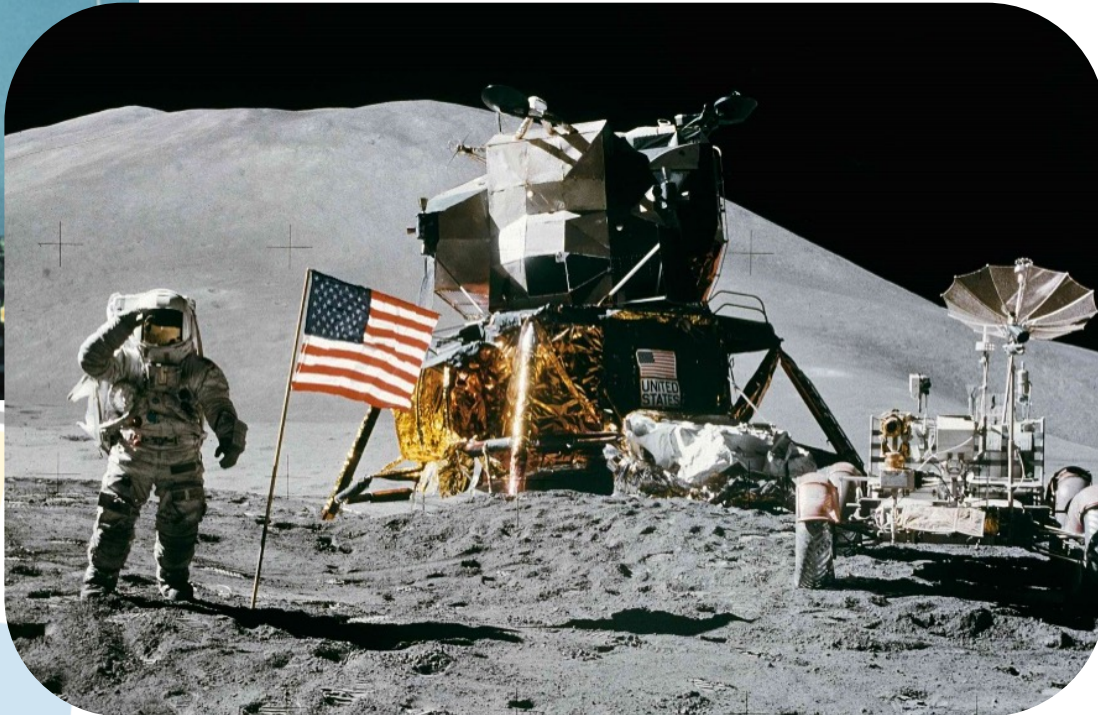
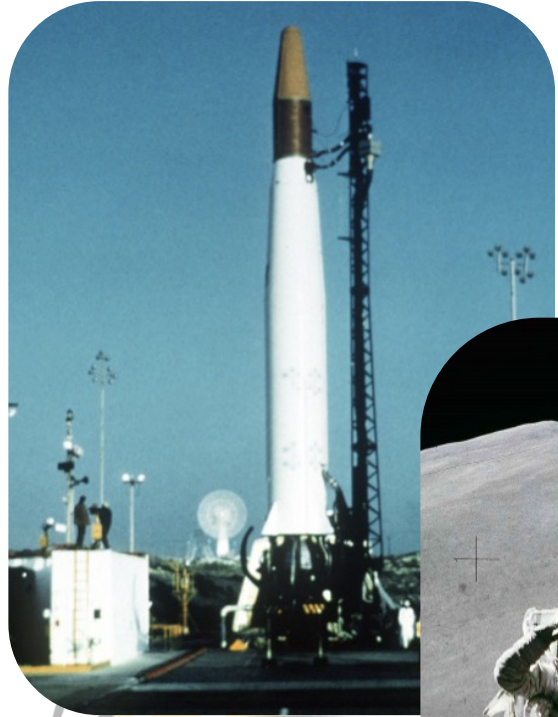
David Long, Blue Holon

Duncan Kemp, UK Ministry of Defence

Erika Palmer, Cornell University

Jon Wade, University of California, San Diego

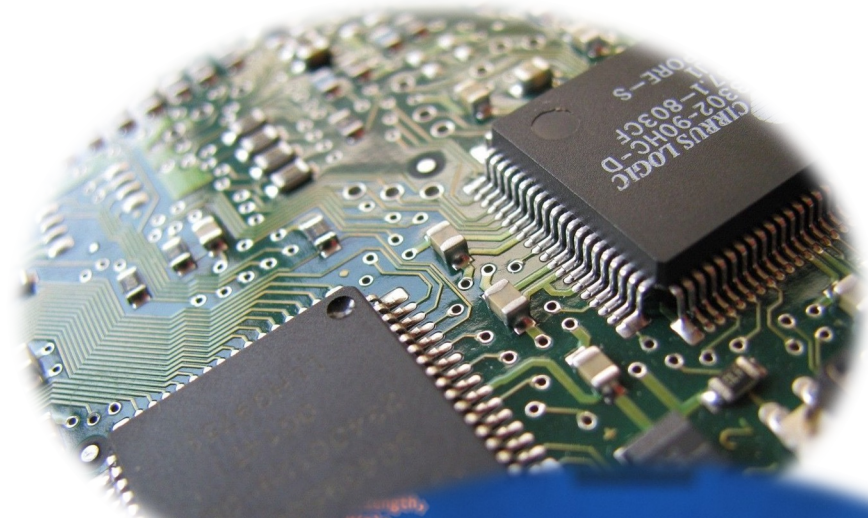
The “Golden Age” of Systems Engineering



Systems in the Modern World



Credit: SpaceX



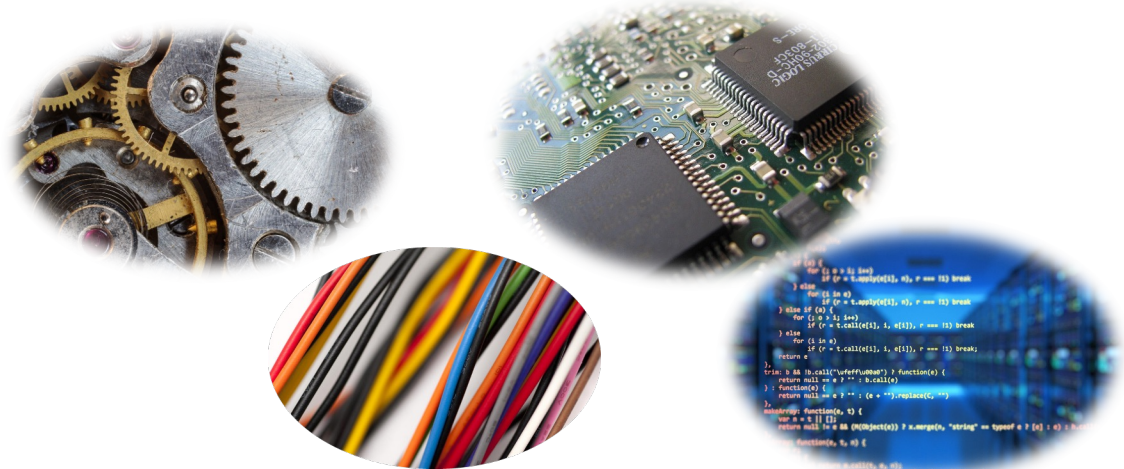
Credit: Boston Dynamics



Looking Beyond Product in the Modern World



Japan Society 5.0



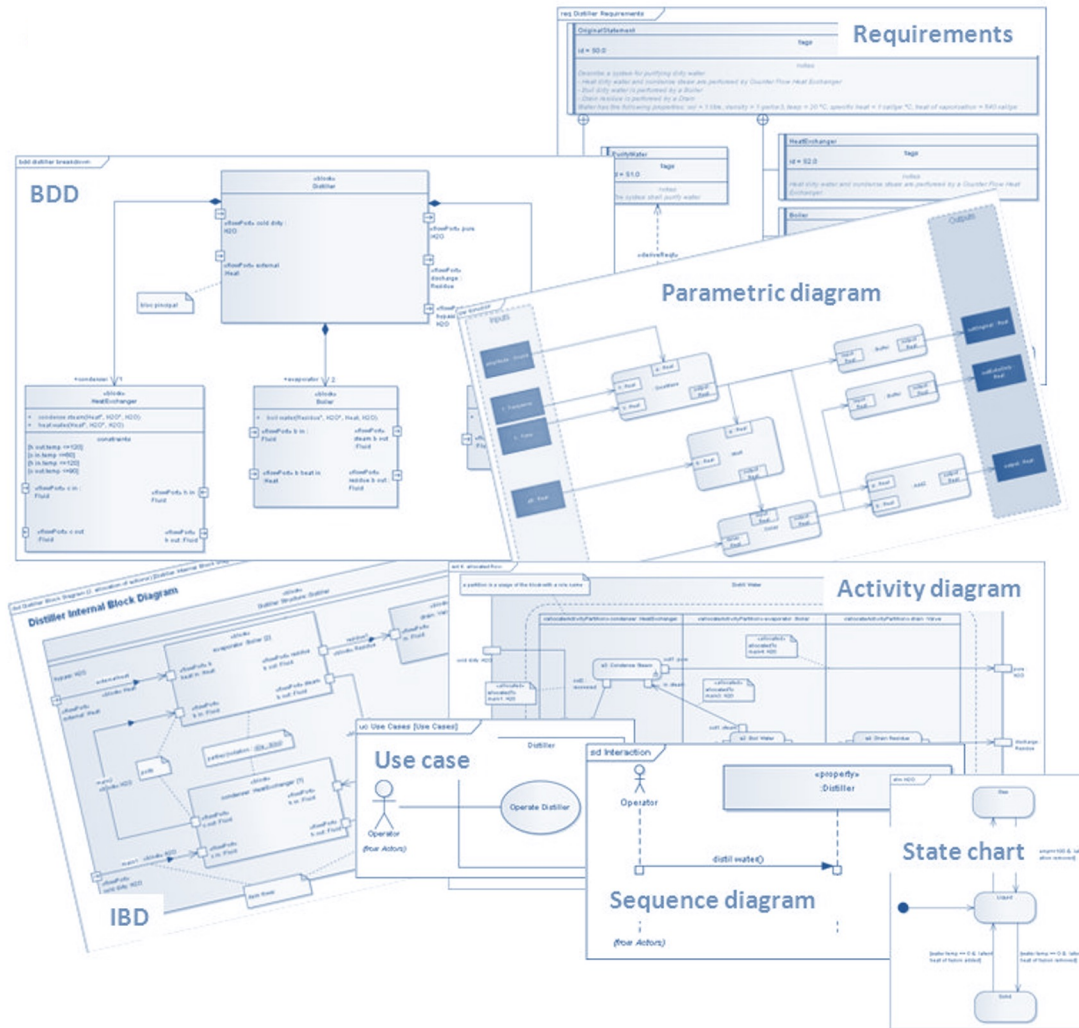
SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD



15-20 July 2023

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Embracing a Broader Foundation



Complex

the relationship between cause and effect can only be perceived in retrospect
probe – sense – respond
emergent practice

Complicated

the relationship between cause and effect requires analysis or some other form of investigation and/or the application of expert knowledge
sense – analyze – respond
good practice

novel practice

no relationship between cause and effect at systems level
act – sense – respond

best practice

the relationship between cause and effect is obvious to all
sense – categorize – respond

Chaotic

Simple

© Cynefin framework by Dan Snowden

Study of Systems



Looking Outward, Embracing Transdisciplinarity

“The whole is greater than the sum of the parts”

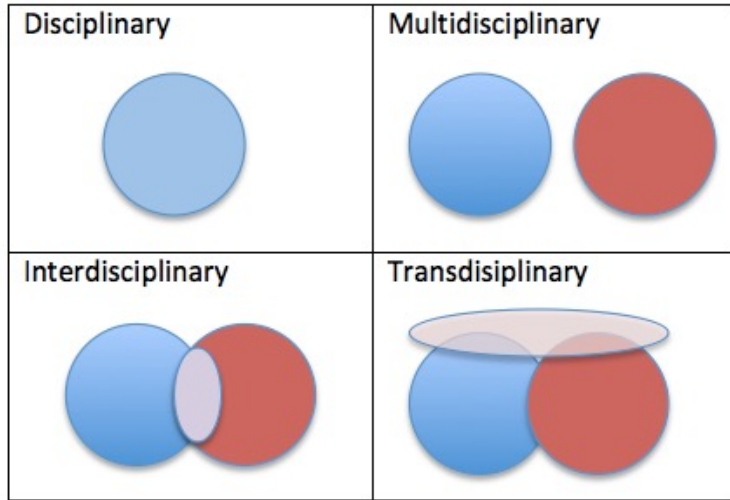


Image Credit: Magellan International School



In essence, radical collaboration is the requirement necessary for the human race to solve its wicked problems.

Erika Palmer



Project



Enterprise



Academia

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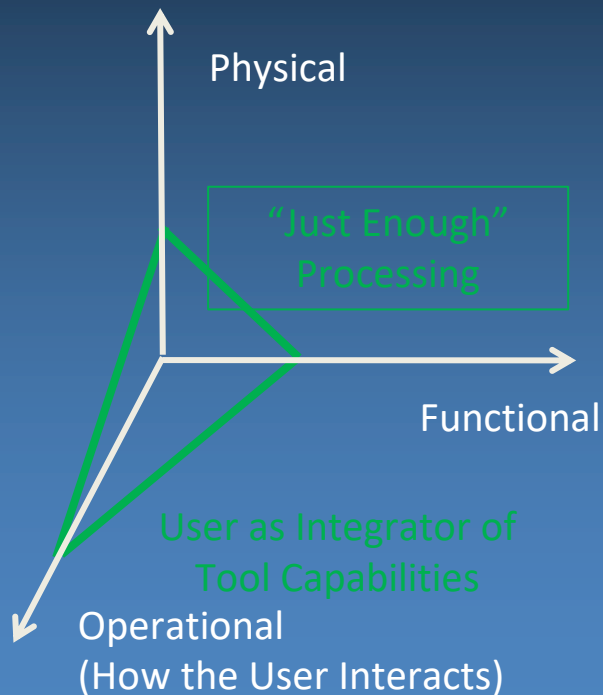


Jon Wade, University of California, San Diego

The Recontextualization of SE

Evolution of System Complexity

Past



Present

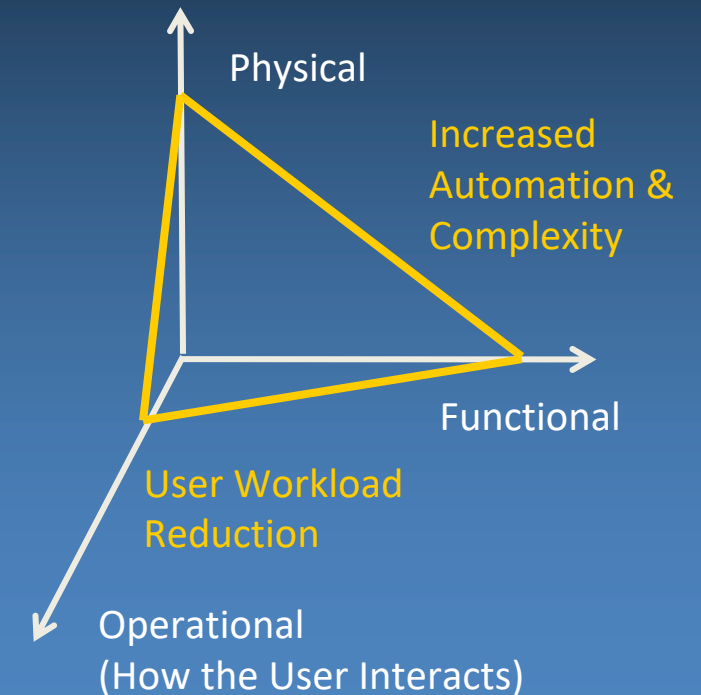


Image Credit: INCOSE Vision 2025

Collaborative Intelligence



IBM's Deep Blue

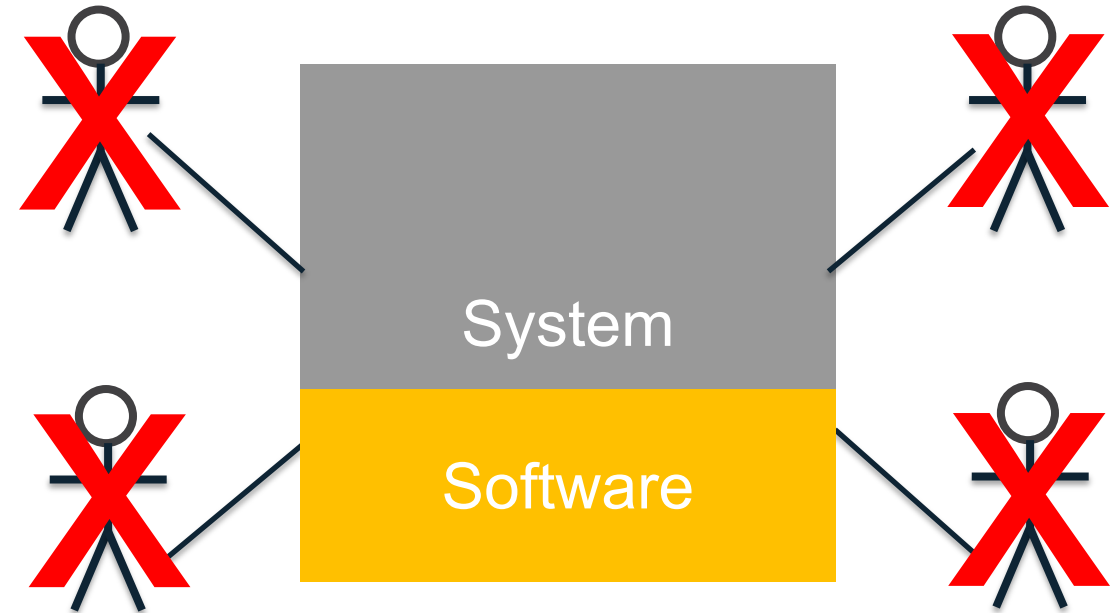
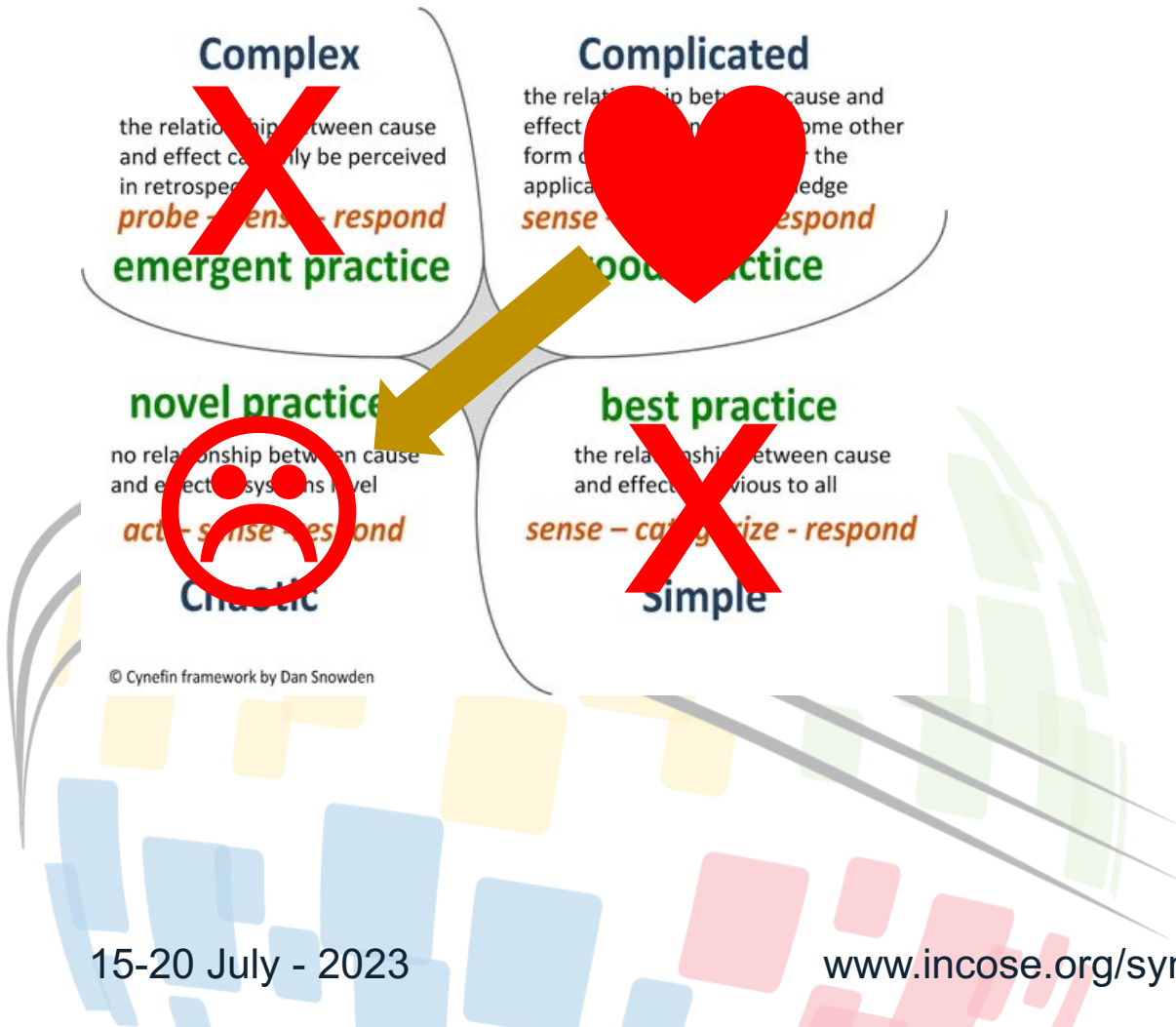


World Champion Garry Kasparov

I reached the formulation that a weak human player plus machine plus a better process is superior, not only to a very powerful machine, but most remarkably, to a strong human player plus machine plus an inferior process.

— Garry Kasparov

KICS - Keep it Complicated, Stupid*



What is the System?

Exploiting the digital power of computation, AI/ML, visualization and communication to take better, faster actions



- Simulated world

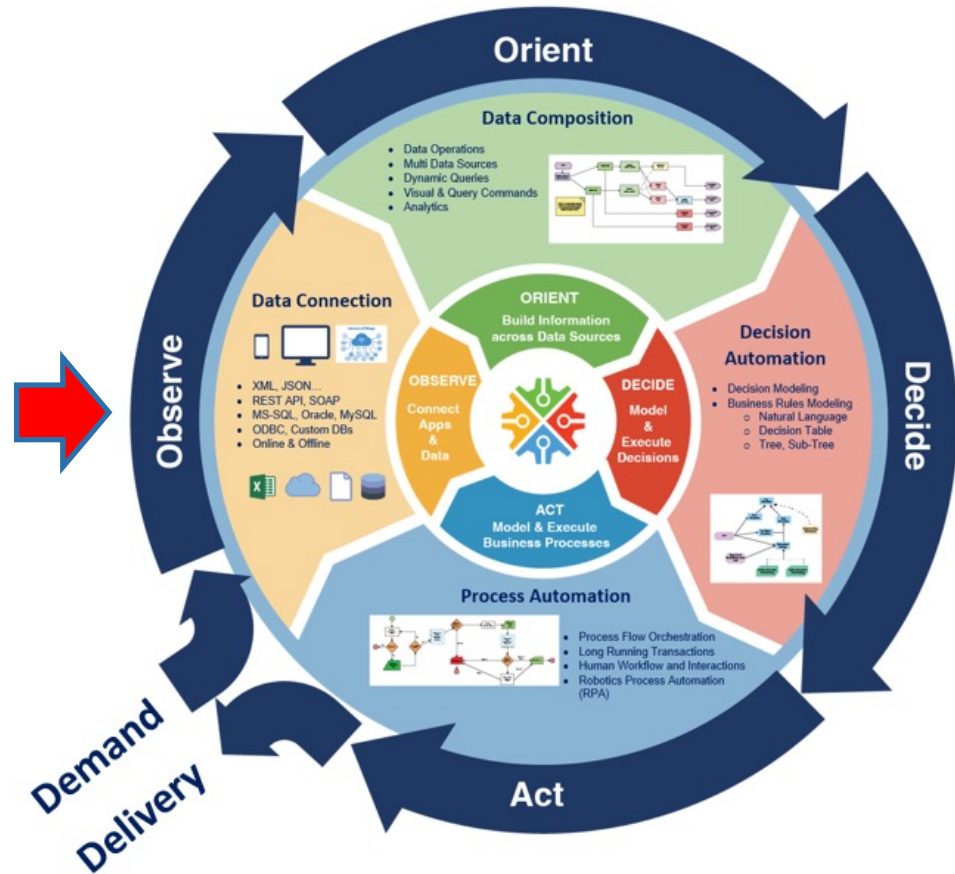
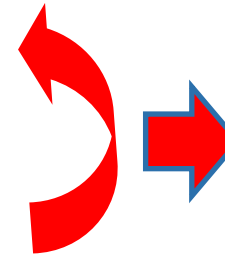


- Experimental data

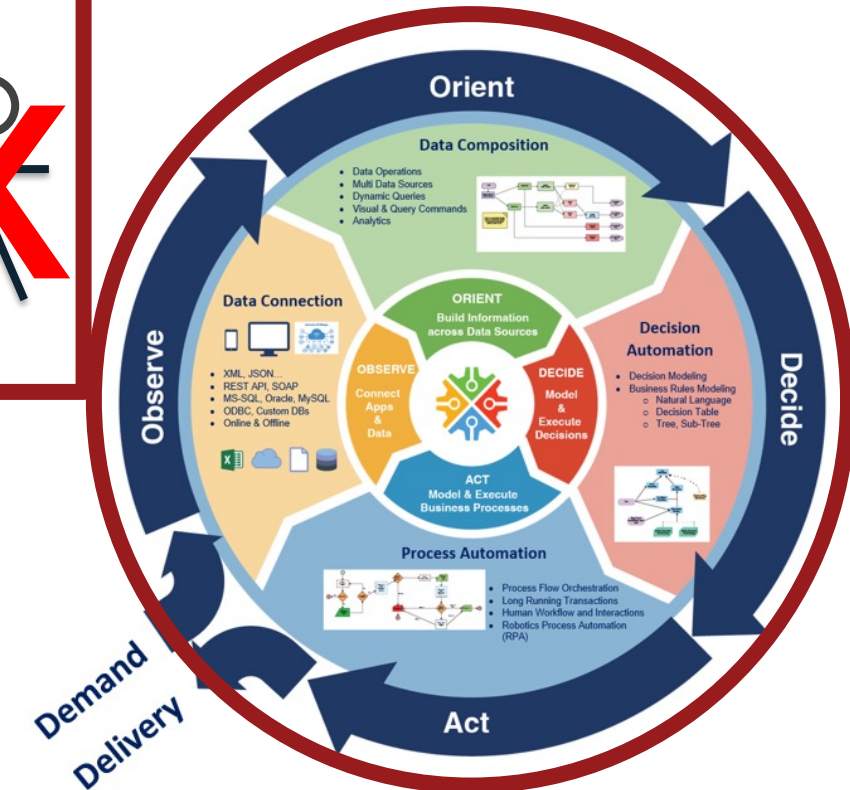
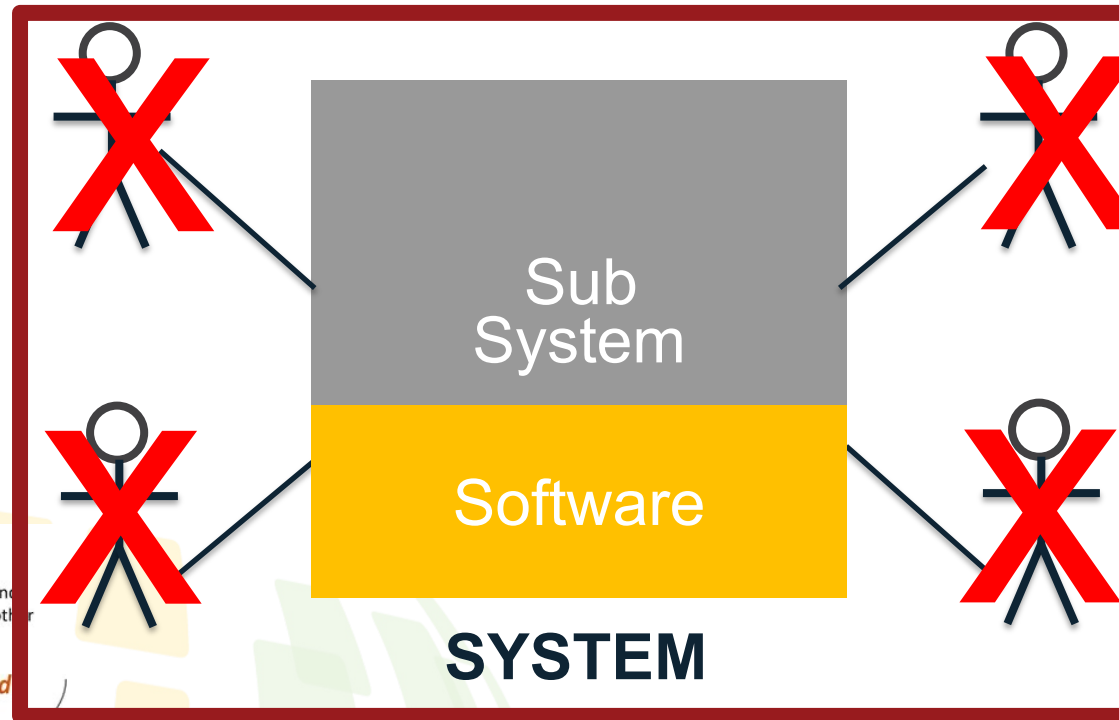
- Observed world

Dynamic
System
Validation

Virtual
Physical



Time for System Engineering to Step Up



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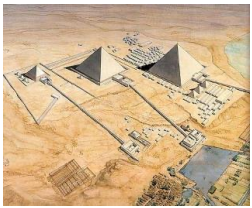


Professor Duncan Kemp, CEng,
FIET, INCOSE Fellow
UK Ministry of Defence

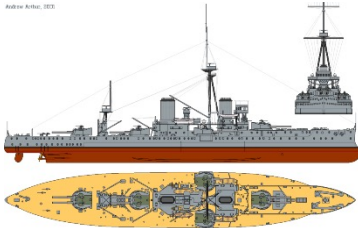
“Those that fail to learn from
history are doomed to repeat it.”



History of Systems Engineering



2600 BC



1900s



1930s



1960s

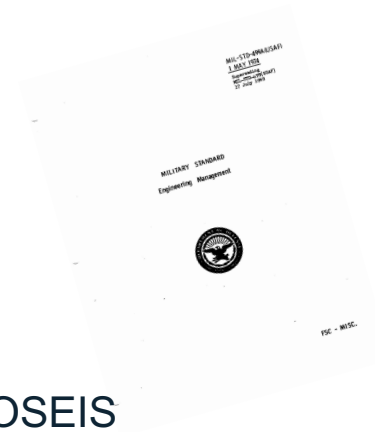


2010s

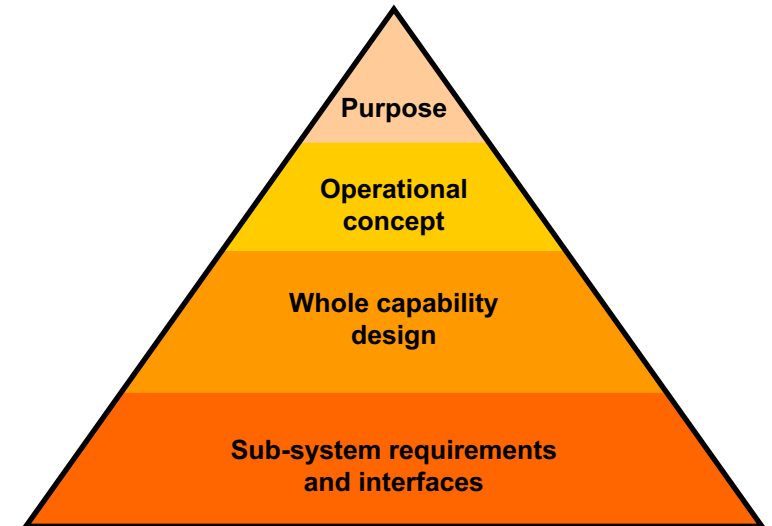
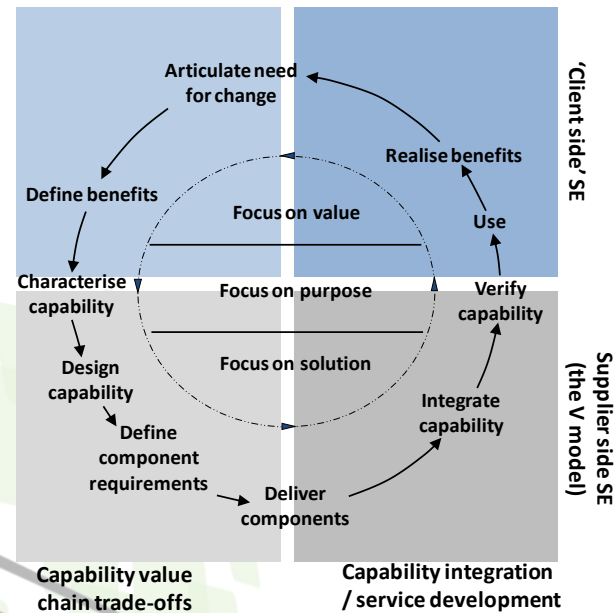
1940s



1970s



Capability Systems Engineering





Dr. Erika Palmer
INCOSE Deputy Technical Director
Cornell University



Systems Engineering Applied to Evaluate Social Systems

Analyzing systemic challenges to the Norwegian welfare state

REVIEW ARTICLE

A systematic literature review of sociotechnical systems in systems engineering

Dana Polojärvi, Erika Palmer, Charlotte Dunford

Using Agent-Based Models for Prediction in Complex and Wicked Systems

J. Gareth Polhill^a, Matthew Hare^a, Tom Bauermann^b, David Anzola^c, Erika Palmer^d, Doug Salt^a and Patrycja Antosz^e



REGULAR PAPER

A methodology for modeling sociotechnical systems to facilitate exploratory policy analysis

Michael J. Pennock, Douglas A. Bodner



JASSSS is an interdisciplinary journal for the exploration and understanding of social processes by means of computer simulation



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