



32nd Annual **INCOSE**
international symposium
hybrid event

Detroit, MI, USA
June 25 - 30, 2022



Death Rays, databases, and double diamonds

Presenters



- 18+ years of systems engineering experience
- Focus on safety critical and business critical systems
- Experience spans industries and concept, design, product launch, manufacturing, and system services
- Co-chair of the INCOSE System Safety Working Group
- Former member of the INCOSE BOD and chair of the Biomedical Working Group

Meaghan O'Neil

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System Design and Strategy Ltd.



- Developed and leads 60 person Internal SE Consultancy at DE&S
- Digital Engineering Implementation Leader
- Over 30 years experience of developing safe and effective systems in Defence, Information Services, and Rail
- Visiting Professor of Systems Thinking at Loughborough University
- Co-chair of the INCOSE System Safety Working Group, INCOSE Fellow, IET Fellow

Professor Duncan Kemp, CEng FIET, INCOSE Fellow

DE&S Fellow for Systems Engineering
Internal Technical Support Team Leader
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Defence Equipment and Support



Presentation overview

- Why we need to focus on the “real problem”
- Why this is hard in practice
- Practitioners experience and lessons learned





Understanding the right problems to solve





Example Signs and Symptoms ...

Z1
Issue 3.0
March 2009

INCOSE UK

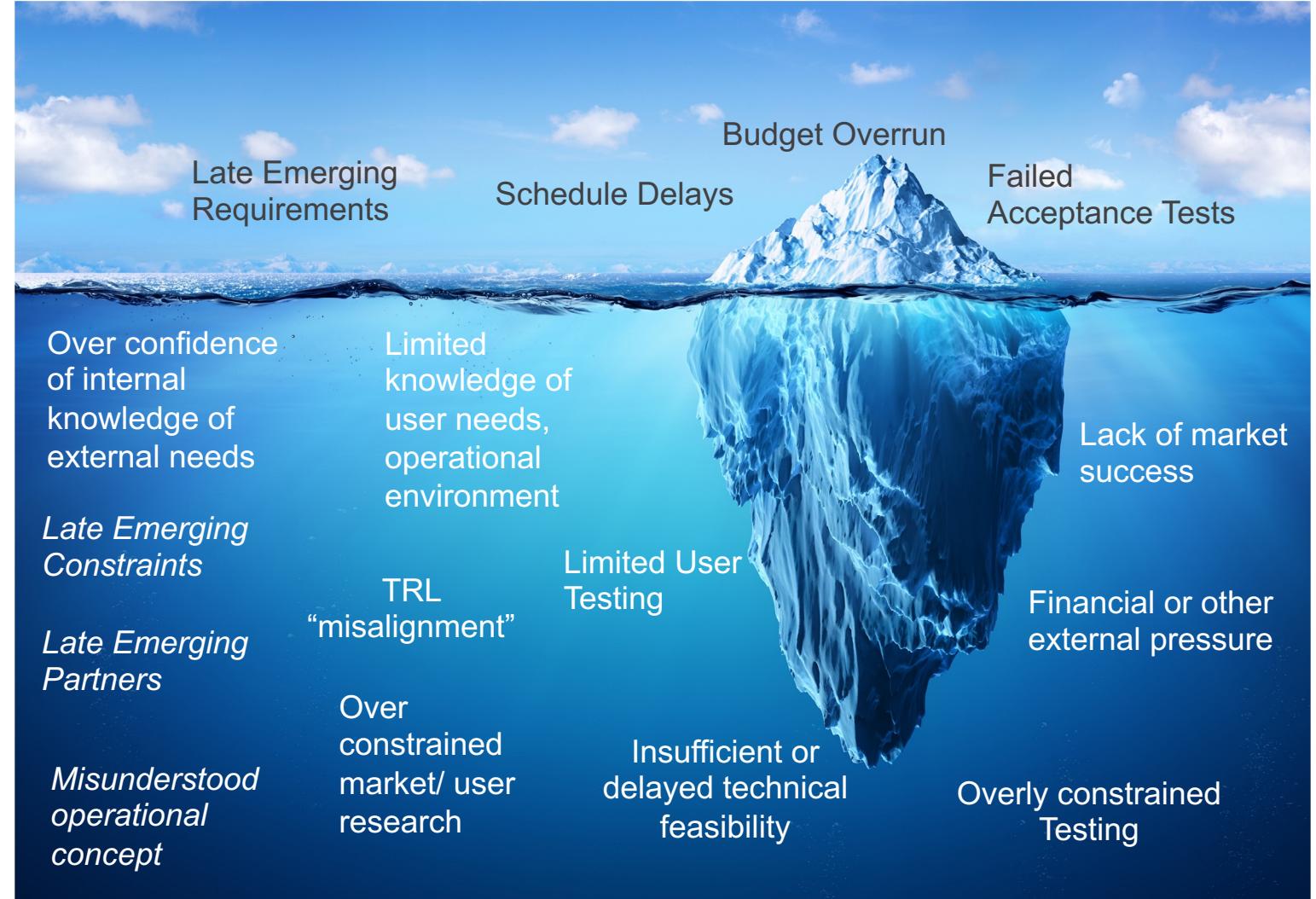
What is Systems Engineering? Creating Successful Systems

Systems Engineering is:
"Big Picture thinking, and the application of Common Sense to projects:"

"a structured and auditable approach to identifying requirements, managing interfaces and controlling risks throughout the project lifecycle."

"Build the right system; build the system right." Systems Engineering considers the whole problem, the whole system, and the whole system lifecycle from concept to disposal, "from lust to dust."

The V lifecycle model shows the logical relationship between the different Systems Engineering activities or 'processes'.



Functional chasms



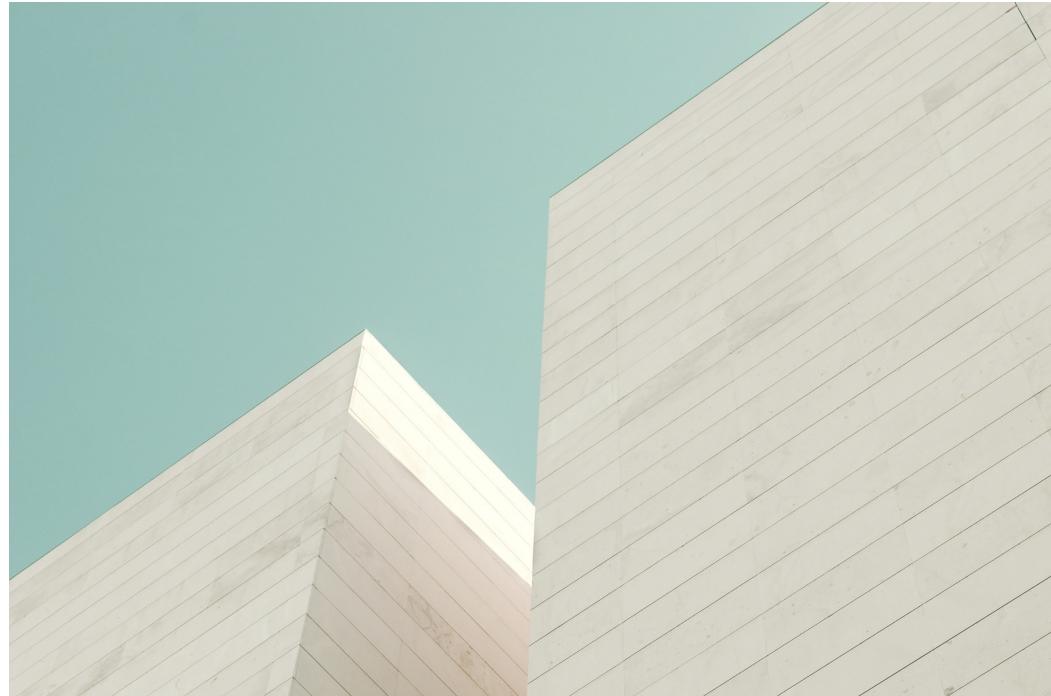
Market Research

Need Exploration

Voice of the Customer

Operational Reality

*Product Specification
(Market Led)*



Technical Feasibility

Technical Specification

Design Specification

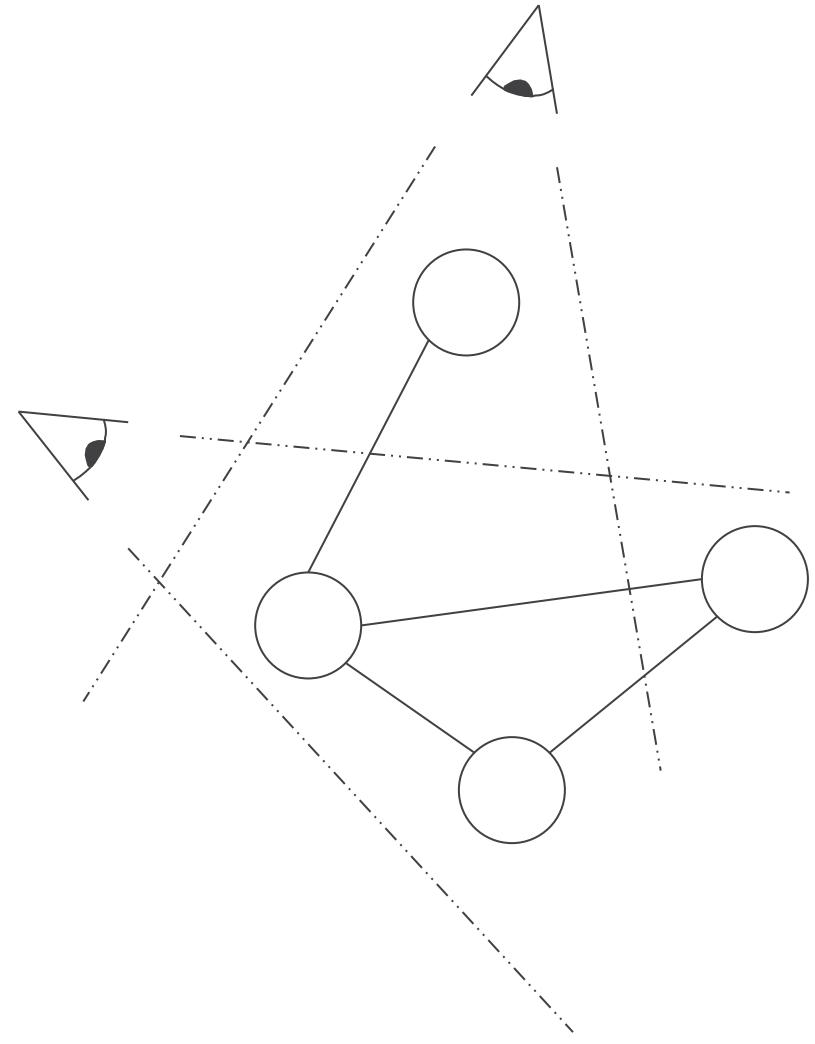
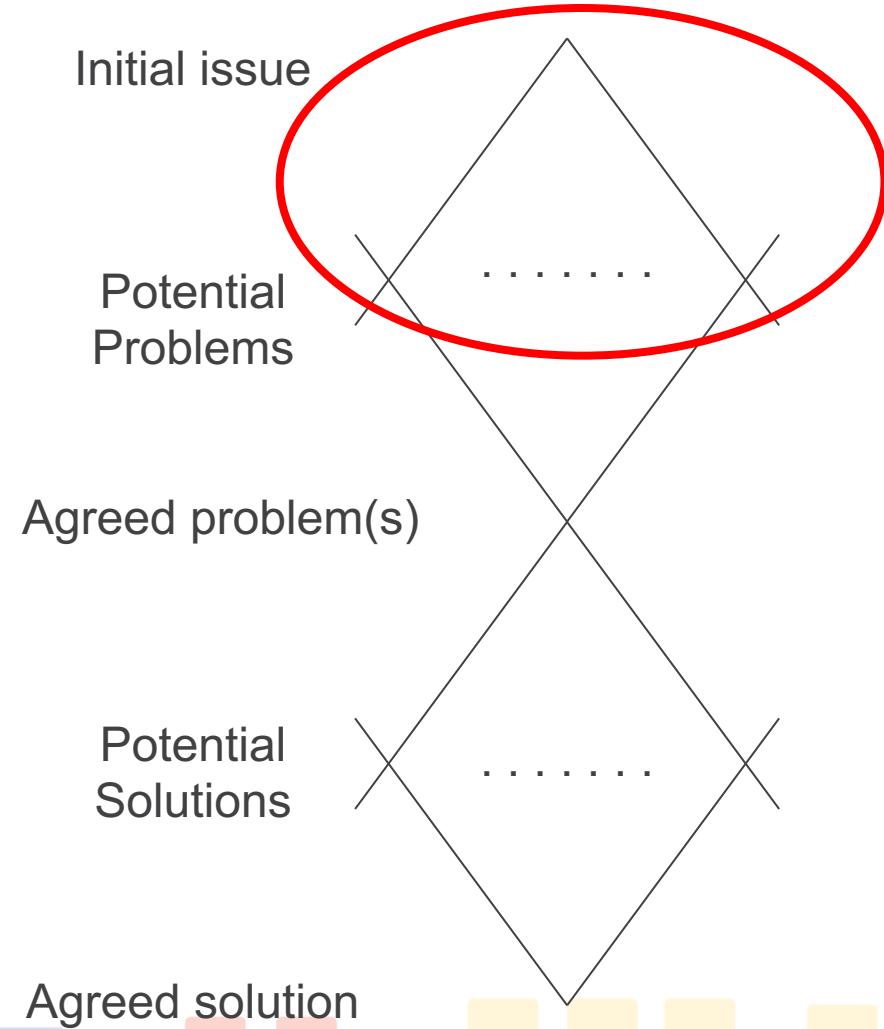
Manufacturing

In Service Support

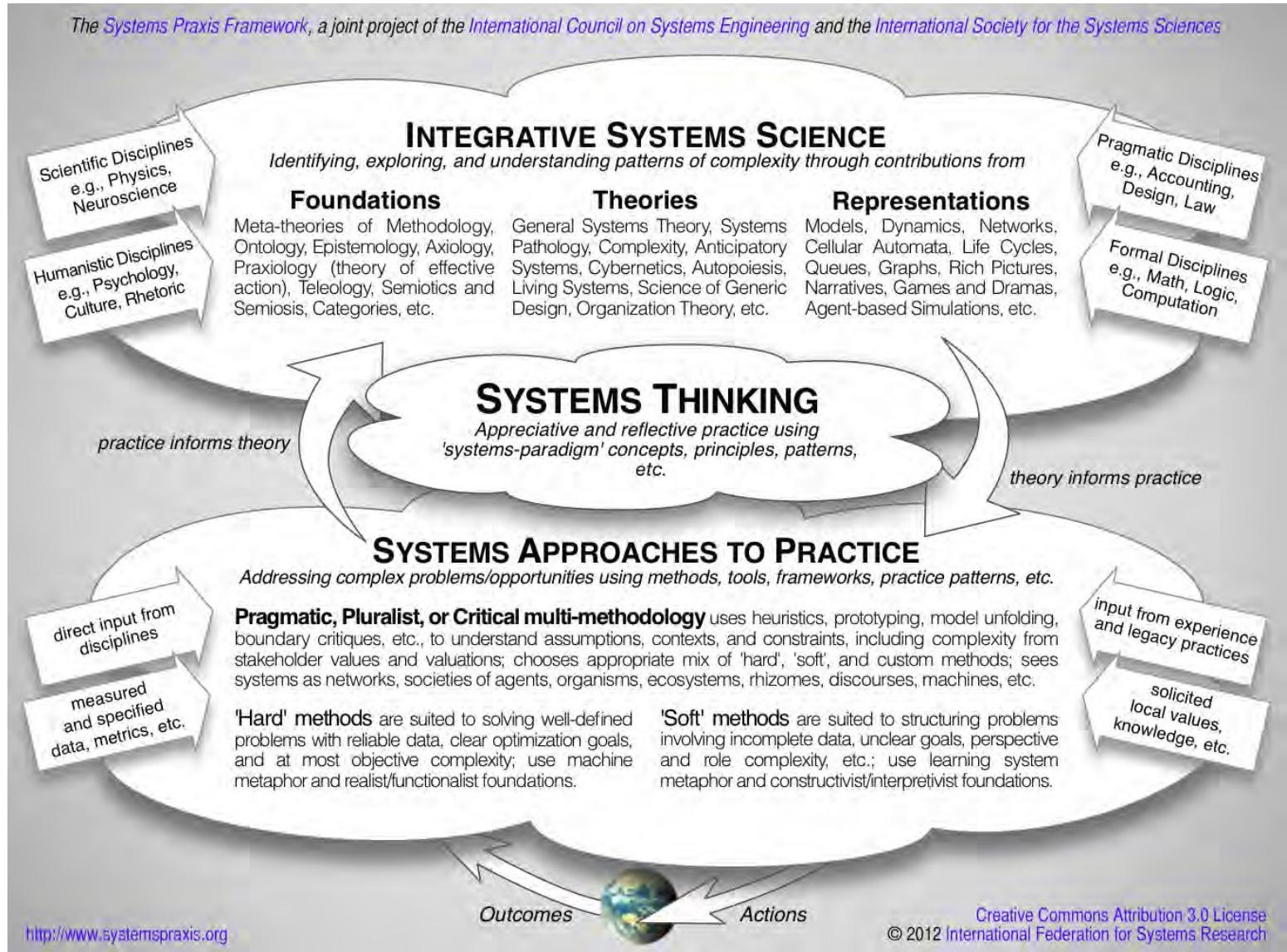




Systems Thinking



So, what can we do?



Navigating in Practice...

Examine Alternatives

*Purpose Boundaries
Perspectives*

Explore Operational Concept

*Normal Maintenance
Fall back*

Develop Understanding

*Context Related Systems
Operating Environment*

Align Ends Ways Means

*These Benefits...
Built to do this...
Using this design...*

Observe / Test

*With proposed users
With old equipment*

2 Up, 2 Down

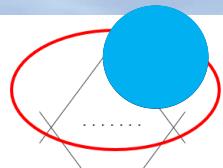
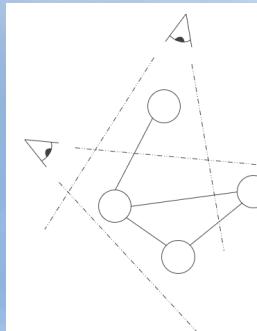
Consistency checks

“drive stake through”

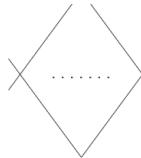
Deep User Conversations

Expert Consultations

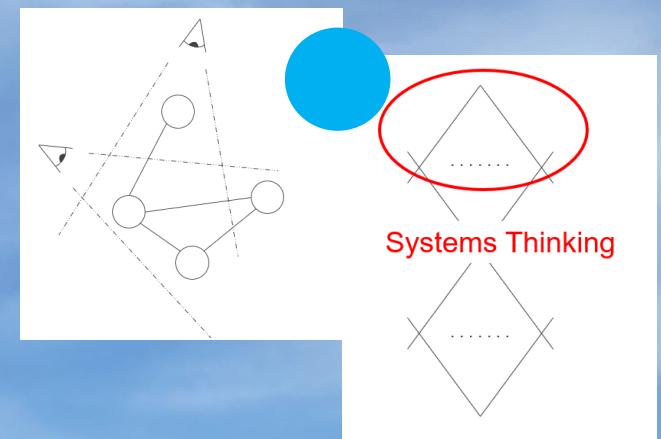
Non-Expert Consultations



Systems Thinking



Obstacles to anticipate



This will cause unacceptable delays

Significant time was already spent on this

Don't overcomplicate things

Needs (and solution) has already been approved

Just get on with it

Approaches to Influencing

Tell a better story

Using their language, heroes, and villains

Provide Better Data

From sources they understand and trust

This will cause unacceptable delays

Significant time was already spent on this

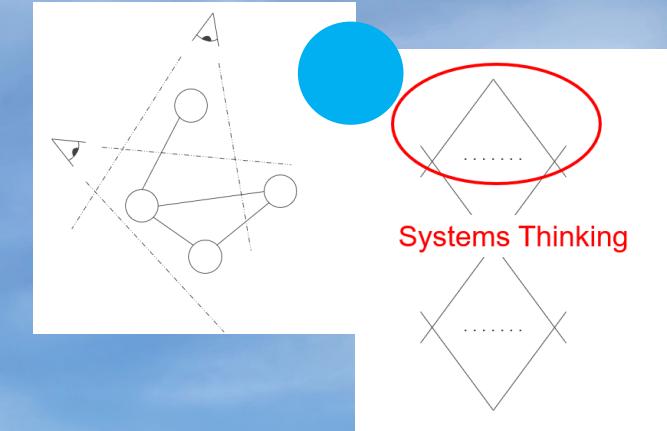
Work their network

Using sources they trust.. (avoid relying on authority)

Needs (and solution) have already been approved

Just get on with it

Don't overcomplicate things



Approaches to Influencing

Tell a better story

*Using their language,
heroes, and villains*

*Understand the
real story*

*Seek the
evidence*

*Find company
historians*

Provide Better Data

*From sources they understand
and trust*

*The situation has
changed*

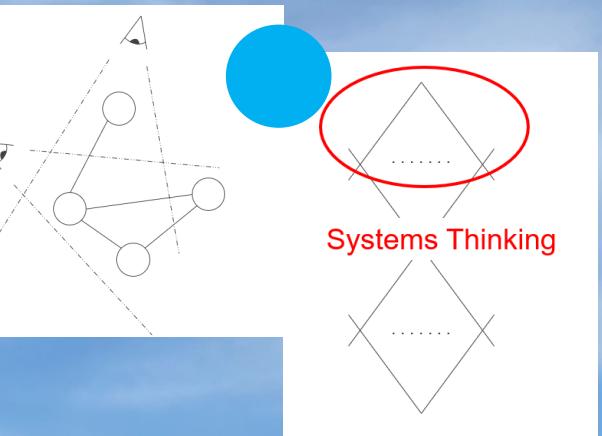
*If we can't do this,
will you cancel the
programme?*

Work their network

*Using sources they trust..
(avoid relying on authority)*

*This is
unbuildable*

*Truth to Power
for safety critical*



*Document
concerns (lose
the battle, win the
war)*

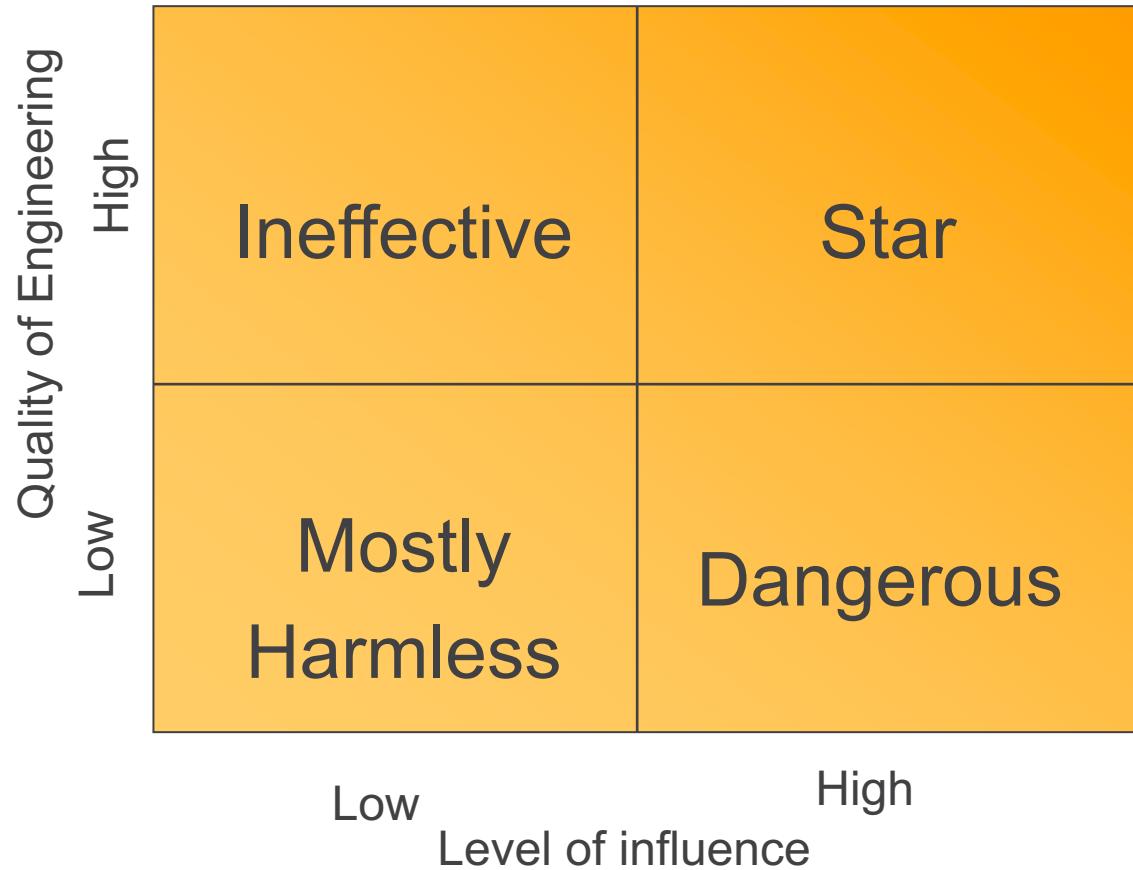
Serenity Prayer

Exit





Effective engineers



Technical Skills

Industry/Domain
Knowledge

Soft Skills

Role experience



Easier in practice than theory ...

“Have we passed Swindon yet?”

“Wow – two hours on the motorway – I am exhausted”

“... why do I keep stalling the engine”

“Mummy is driving – that looks fun”

Unconscious Competence

Conscious Competence

Conscious Incompetence

Unconscious Incompetence

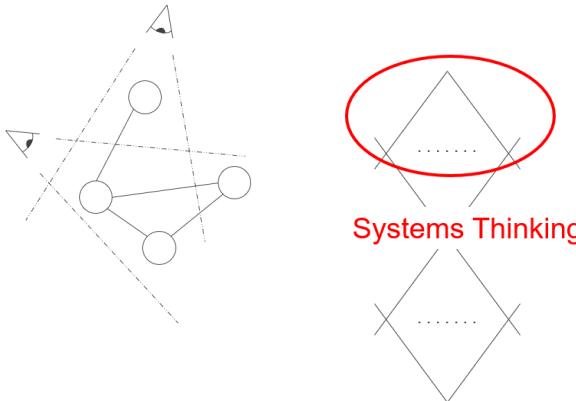
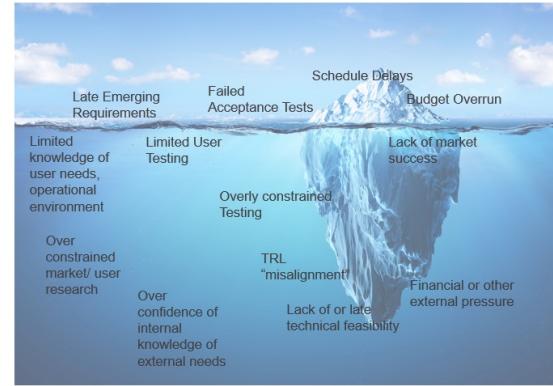
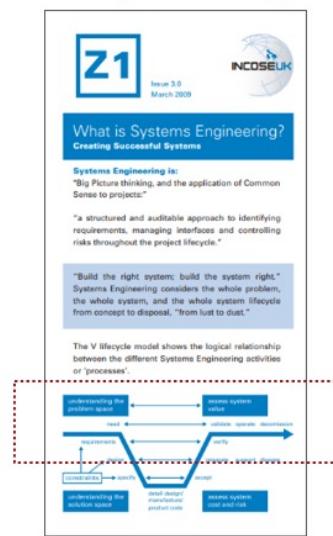
“We don’t need a ‘one size fits none’ solution here””

“Hang on, how is that going to work”

“ ... I should really have said this in the meeting”

“That’s just common sense – anyone can do it”

Summary





Questions for the Presenters?



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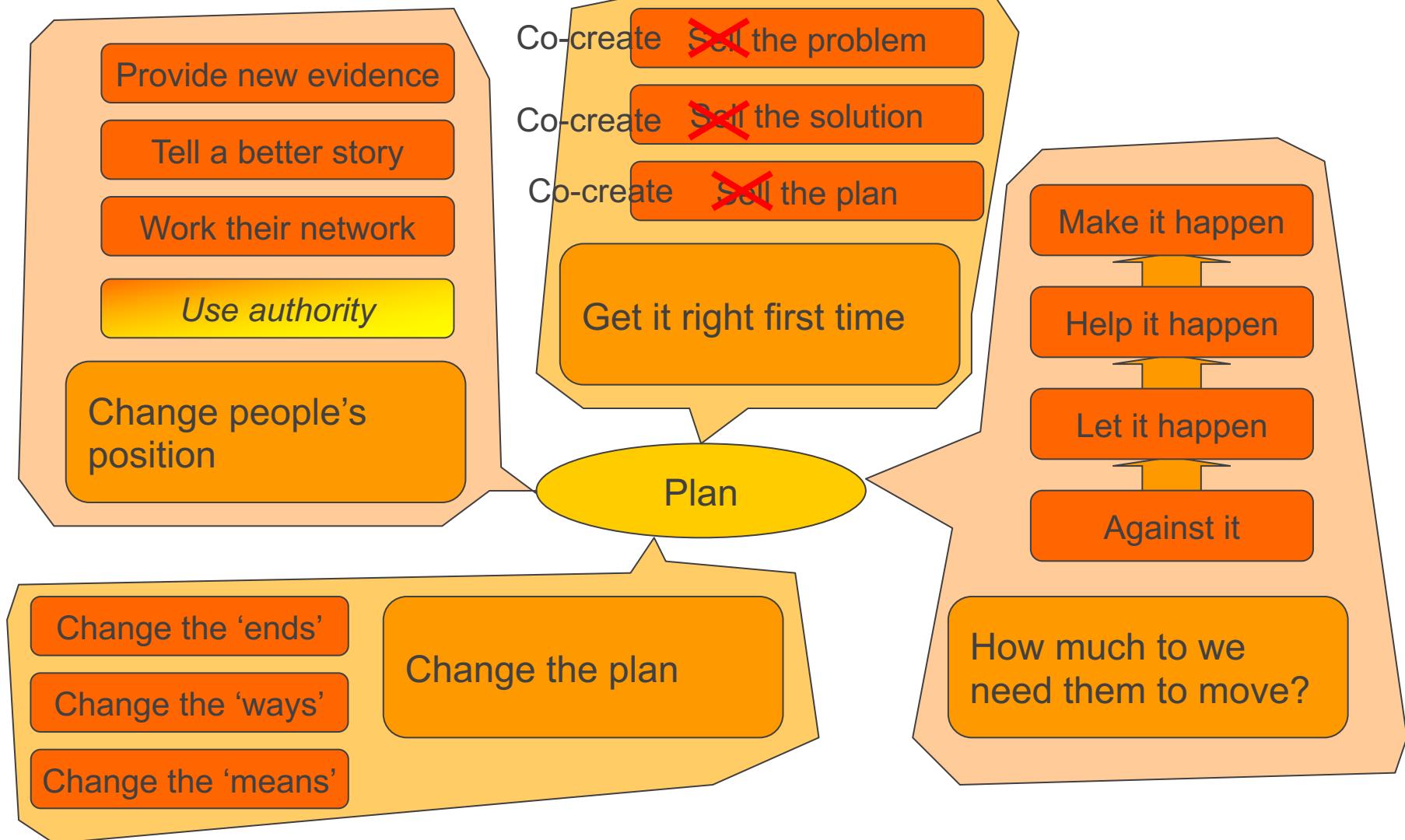


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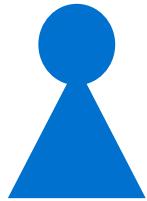
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www.incose.org/symp2022

Focussing on what matters to people



Decide the appropriate team structure: embedded project engineers, SE augmentation or SE product delivery. Get the right balance between in-house employees and external contractors



*Through life
project engineer*



SE Augmentation



*SE Product
delivery*