# NDIA 10853 Panel: In search of the Principles of SE (BKCASE)

Rick Adcock, Cranfield University

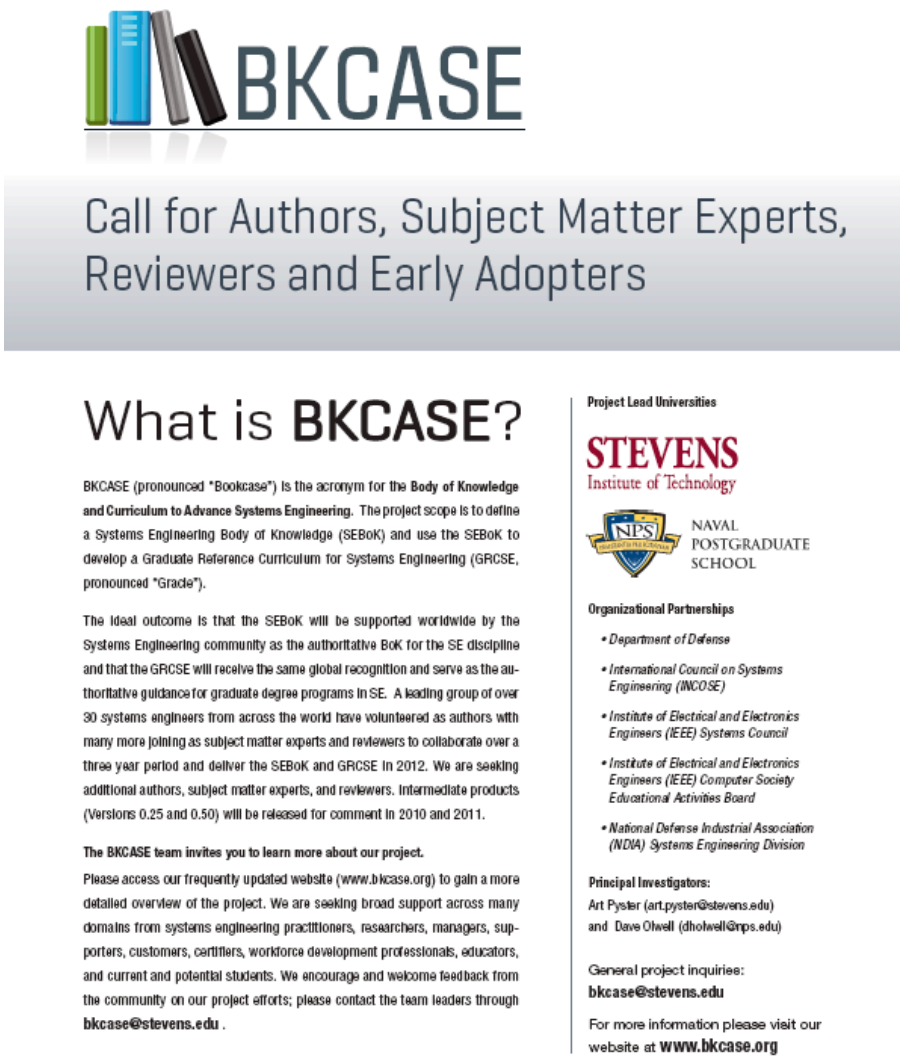
Head of SE Defence Academy of the UK

# Panel

- Rick Adcock
- Art Pyster
- Don Gelosh
- Rich Freeman
- Barry Boehm

# What is BKCASE?

- Project led by Stevens Institute of Technology and Naval Postgraduate School who are creating two primary products:
  - Body of Knowledge in systems engineering (SEBoK)
  - Graduate Reference Curriculum in Systems Engineering (GRCSE)
- Started in September 2009 and will run through 2012
- Intended for world-wide use
- Not intended to be used directly for accreditation



BKCASE

Call for Authors, Subject Matter Experts, Reviewers and Early Adopters

What is **BKCASE**?

BKCASE (pronounced "Bookcase") is the acronym for the **Body of Knowledge and Curriculum to Advance Systems Engineering.** The project scope is to define a Systems Engineering Body of Knowledge (SEBoK) and use the SEBoK to develop a Graduate Reference Curriculum for Systems Engineering (GRCSE, pronounced "Gracie").

The ideal outcome is that the SEBoK will be supported worldwide by the Systems Engineering community as the authoritative BoK for the SE discipline and that the GRCSE will receive the same global recognition and serve as the authoritative guidance for graduate degree programs in SE. A leading group of over 30 systems engineers from across the world have volunteered as authors with many more joining as subject matter experts and reviewers to collaborate over a three year period and deliver the SEBoK and GRCSE in 2012. We are seeking additional authors, subject matter experts, and reviewers. Intermediate products (Versions 0.25 and 0.50) will be released for comment in 2010 and 2011.

**The BKCASE team invites you to learn more about our project.**

Please access our frequently updated website (www.bkcase.org) to gain a more detailed overview of the project. We are seeking broad support across many domains from systems engineering practitioners, researchers, managers, supporters, customers, certifiers, workforce development professionals, educators, and current and potential students. We encourage and welcome feedback from the community on our project efforts; please contact the team leaders through **bkcase@stevens.edu** .

**Project Lead Universities**

STEVENS Institute of Technology

NPS NAVAL POSTGRADUATE SCHOOL

**Organizational Partnerships**

- *Department of Defense*
- *International Council on Systems Engineering (INCOSE)*
- *Institute of Electrical and Electronics Engineers (IEEE) Systems Council*
- *Institute of Electrical and Electronics Engineers (IEEE) Computer Society Educational Activities Board*
- *National Defense Industrial Association (NDIA) Systems Engineering Division*

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For more information please visit our website at **www.bkcase.org**

# BKCASE Vision and Objectives

## Vision

"Systems Engineering competency models, certification programs, textbooks, graduate programs, and related workforce development initiatives around the world align with BKCASE."

## Objectives

1. Create a SEBoK that is globally recognized by the SE community as the authoritative BoK for the SE discipline.
2. Create a graduate reference curriculum for SE (GRCSE – pronounced "Gracie") that is globally recognized by the SE community as the authoritative guidance for graduate programs in SE.
3. Facilitate the global alignment of related workforce development initiatives with SEBoK and GRCSE.
4. Transfer stewardship of SE BoK and GRCSE to INCOSE and the IEEE after BKCASE publishes version 1.0 of those products, including possible integration into their certification, accreditation, and other workforce development and education initiatives.

# Agenda

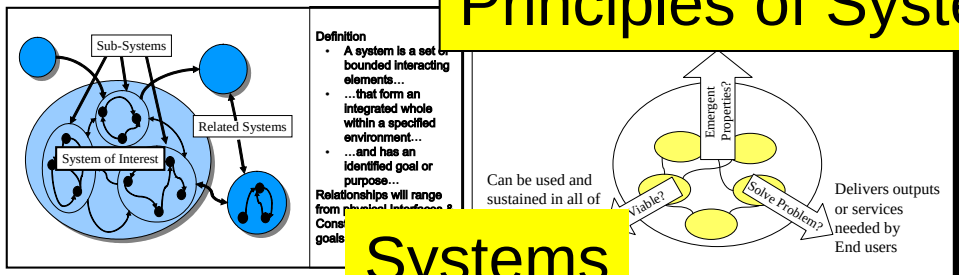
- Questions:
  - Why should DoD (and other nations) be interested in a Systems Engineering BoK?
  - What is the value of Systems Engineering in Defense?
  - How does Systems Engineering relate to other disciplines it?
  - What Systems Engineering skills do we need to make this happen?

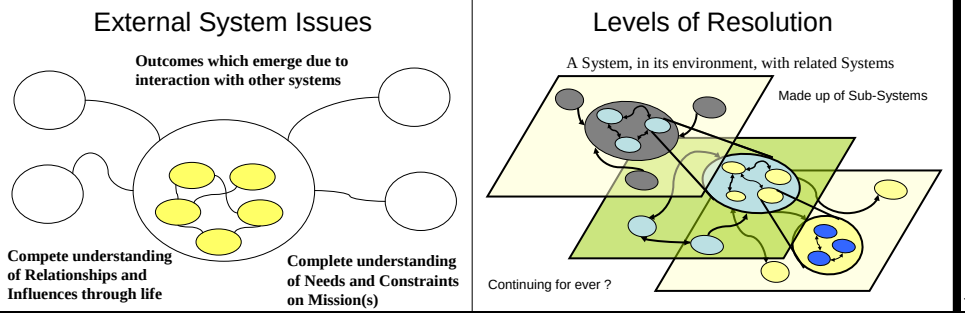
# Principles

- What does it mean to apply Engineering to a system?
- Two definitions of Engineering:
  - The application of scientific knowledge to practical problems, or the creation of useful things.
  - To (cleverly) arrange for something to happen.
- Systems Engineering is traditionally associated with the first of these, as applied to Product Development
- We may also need to consider the second when we look at the wider application of Systems Engineering to Enterprise Success.

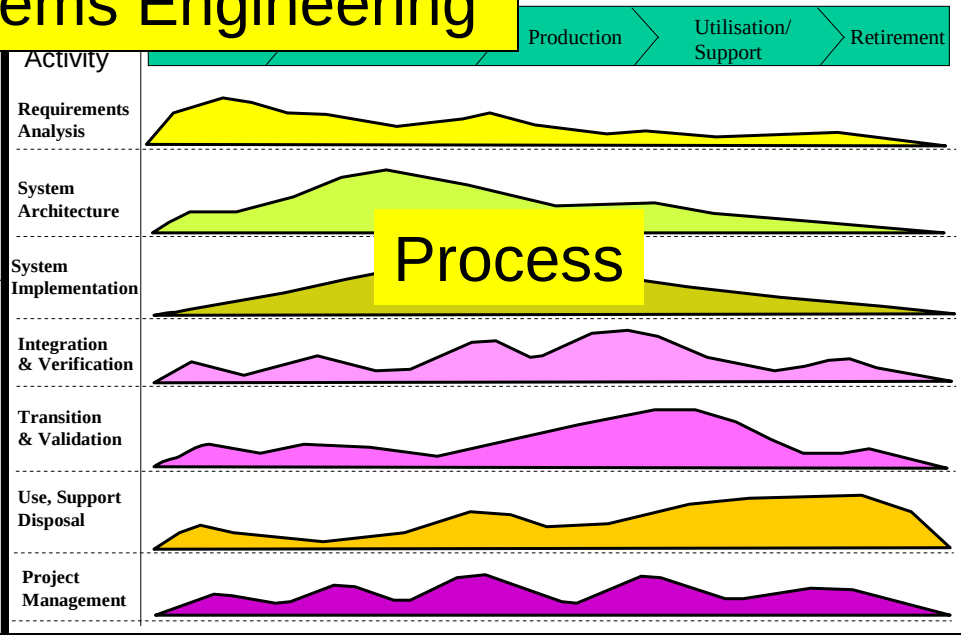
# Principles of Systems Engineering

## Systems

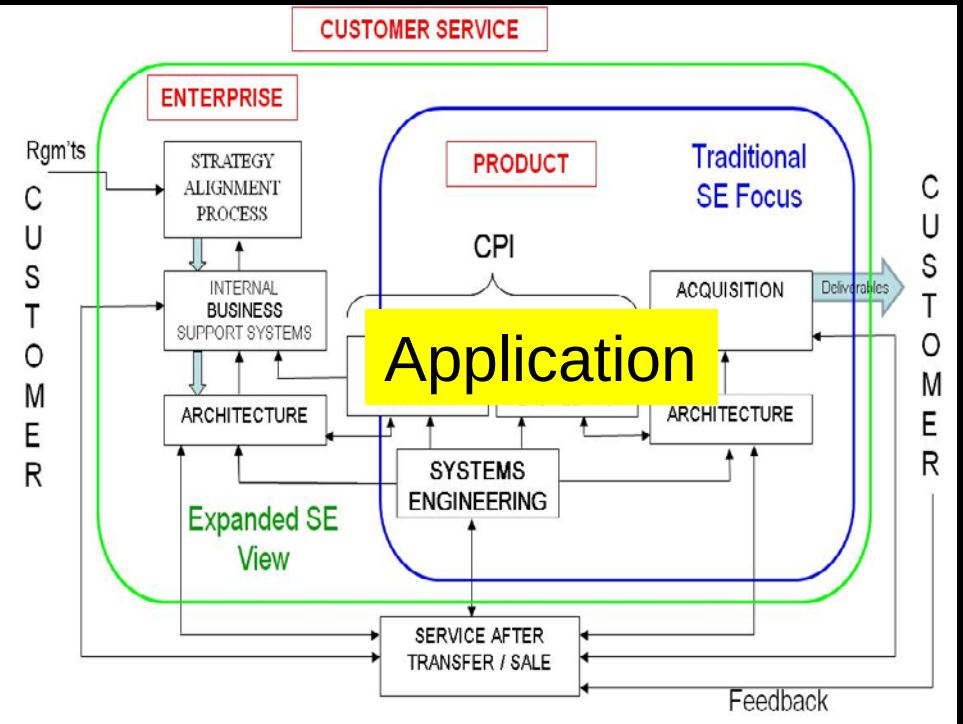


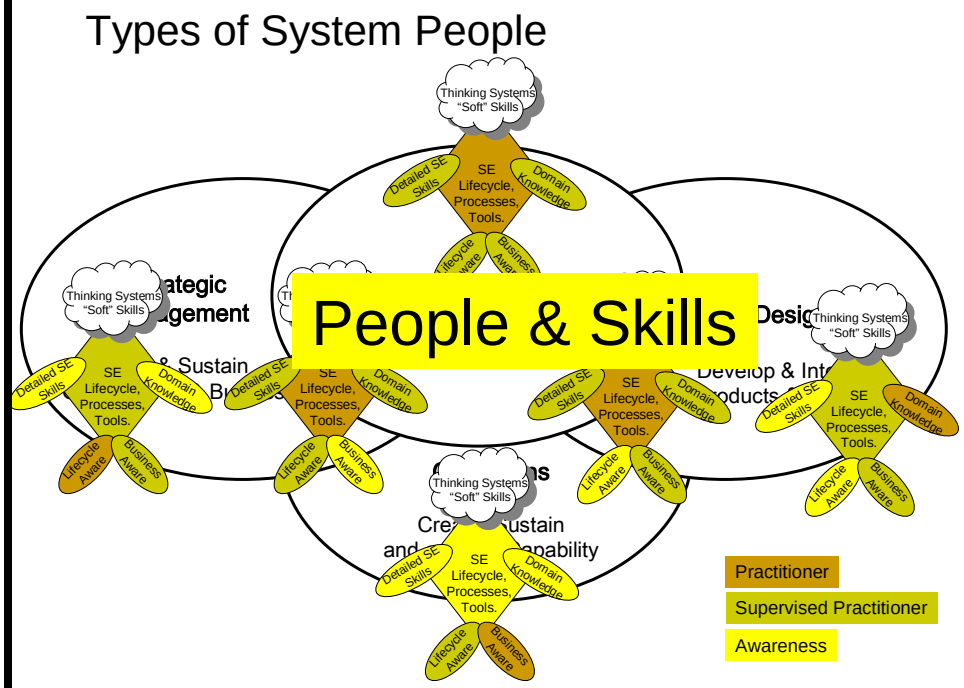

## Process



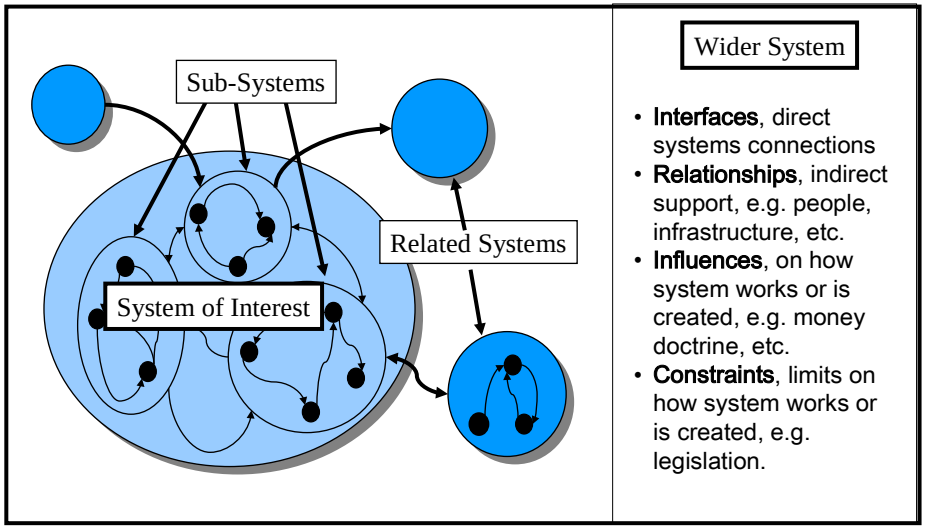

## Application



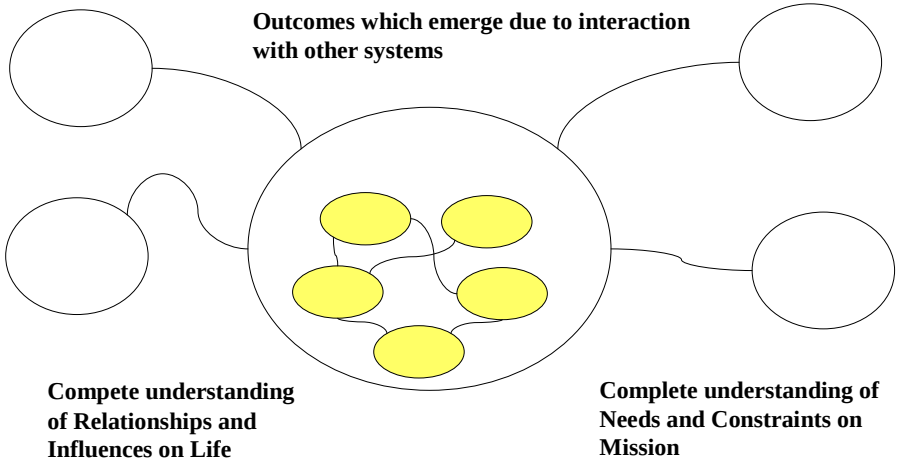

## People & Skills



# System

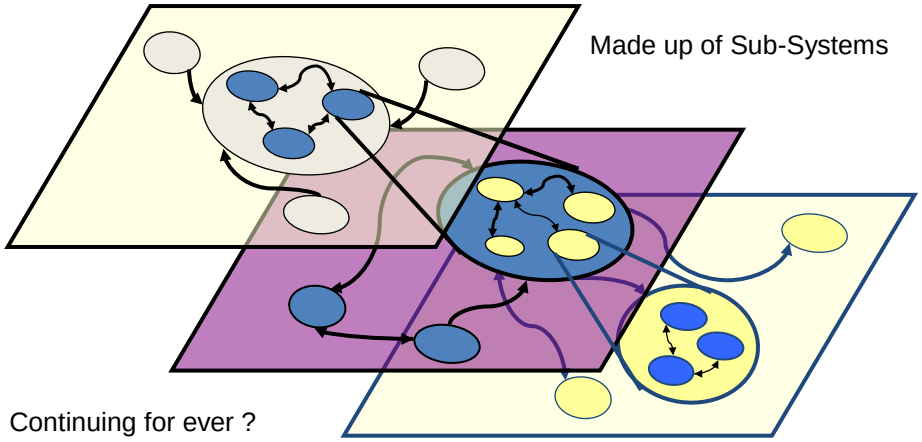



# External System Issues

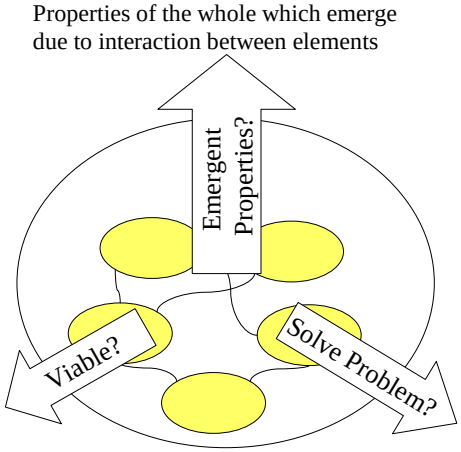



# Levels of Resolution

A System, in its environment, with related Systems




# Internal System Issues



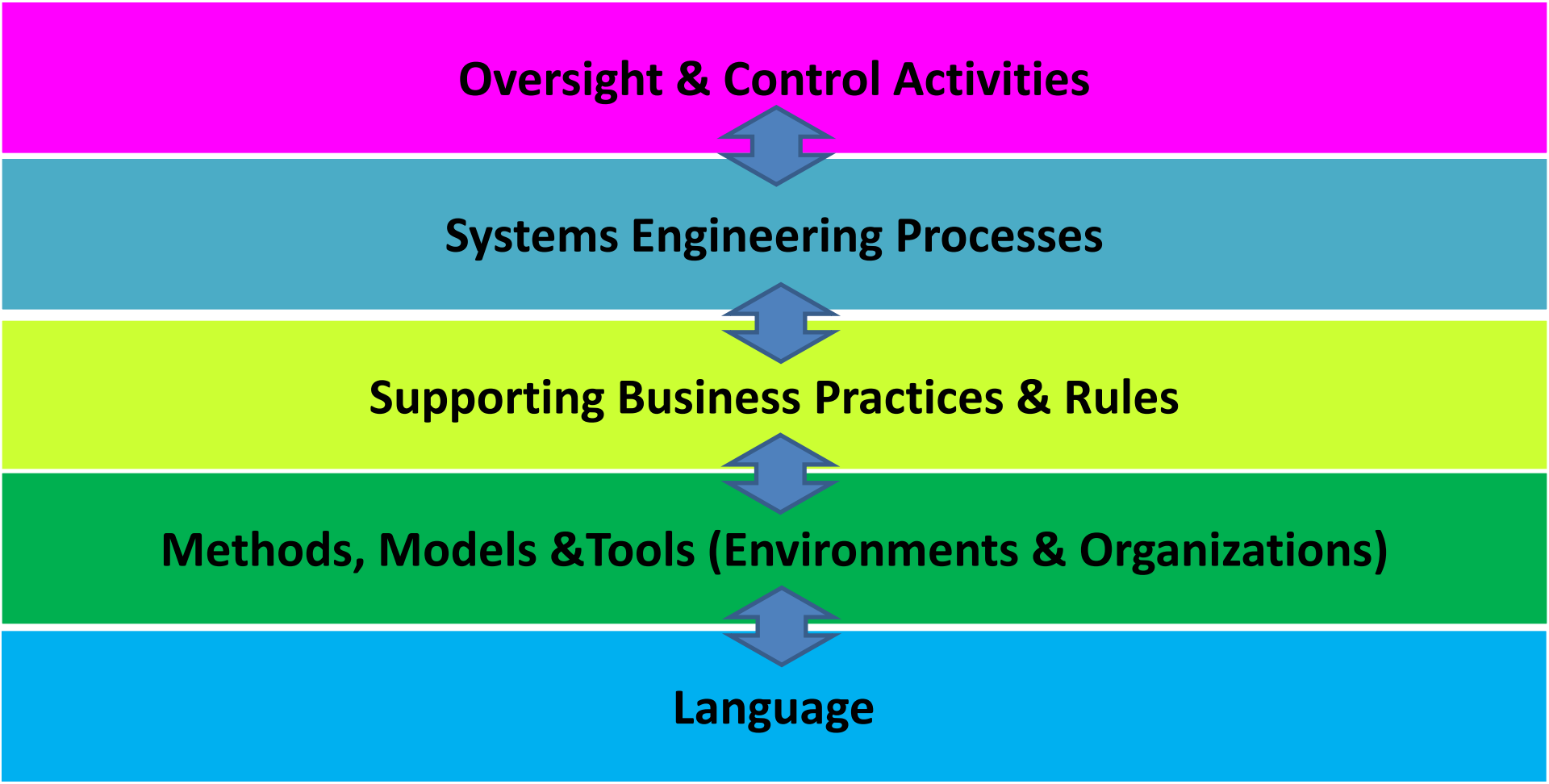

Can be used and sustained in all of its potential environments, through its life

Delivers outputs or services needed by End users

# Systems Approach

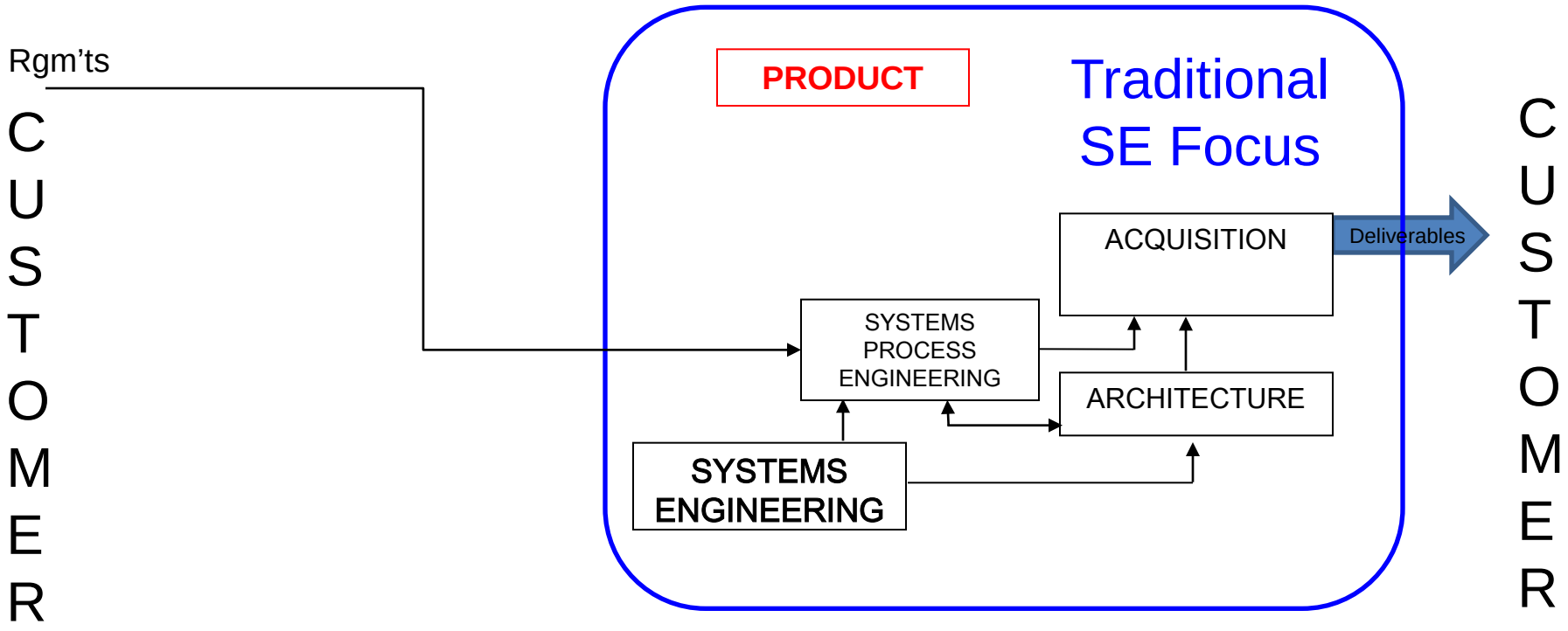
- Taking a systems approach to engineering expands the scope of scientific knowledge to include systems science or systems thinking.
- This approach will seek to
  - define problems, constraints and measures of success outside the boundary of a system of interest and
  - select and combine system elements and relationships inside the boundary in the context of wider system view.
  - It is fundamental to this view of engineering that it is both iterative and recursive in nature.
    - It includes iterative cycling between problem understanding in a wider system context, solution creation within a bounded context and solution insertion and use back in the wider context.
    - We can recursively use this system of interest, wider context approach to tackle problems at several levels of abstraction to deliver solutions to real world problems.
  - To do this we will need ways of assess and dealing with the different properties which arise from combinations of system elements at a number of levels of abstraction.

# Layered Framework



# Systems Engineering

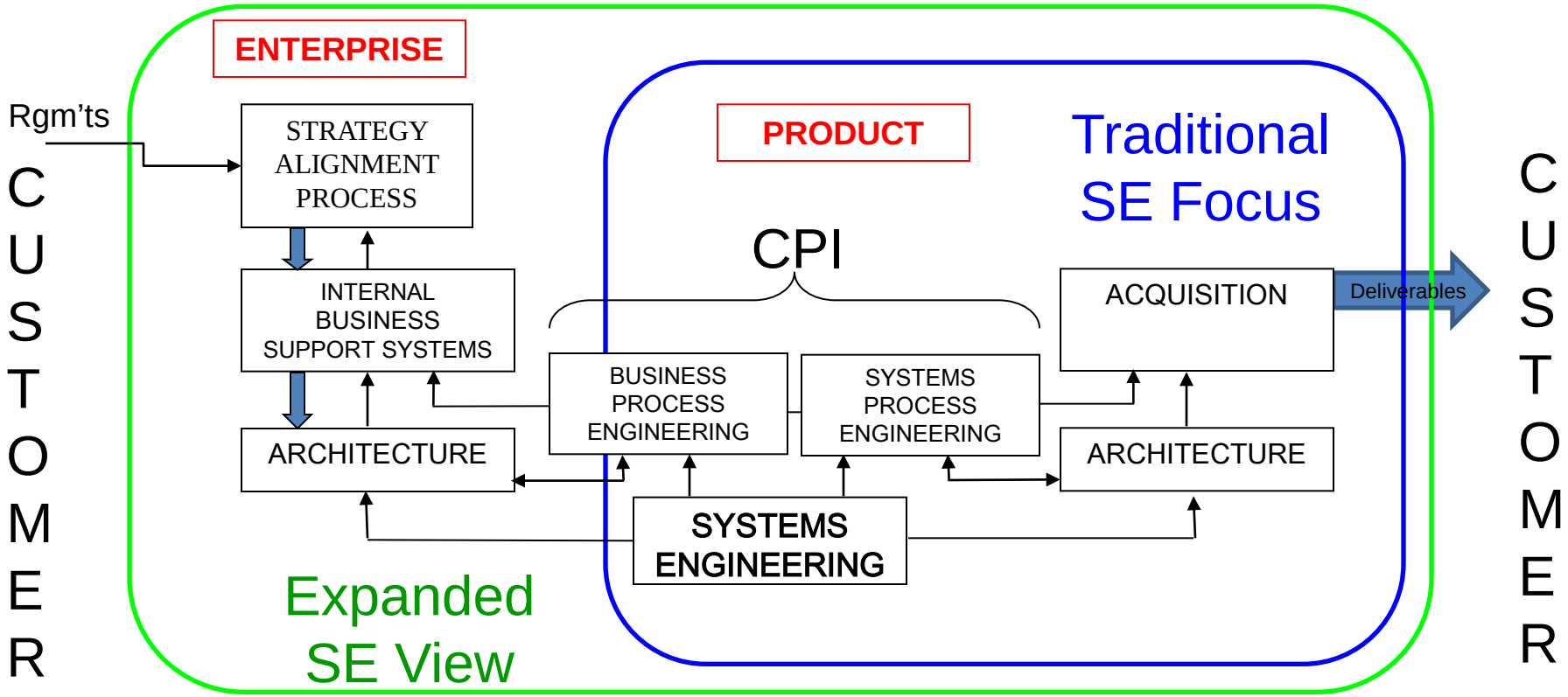
## Product, Enterprise & Customer Service View Model




**Integrated Systems Engineering: Looking Beyond Traditional Realms**

# Systems Engineering

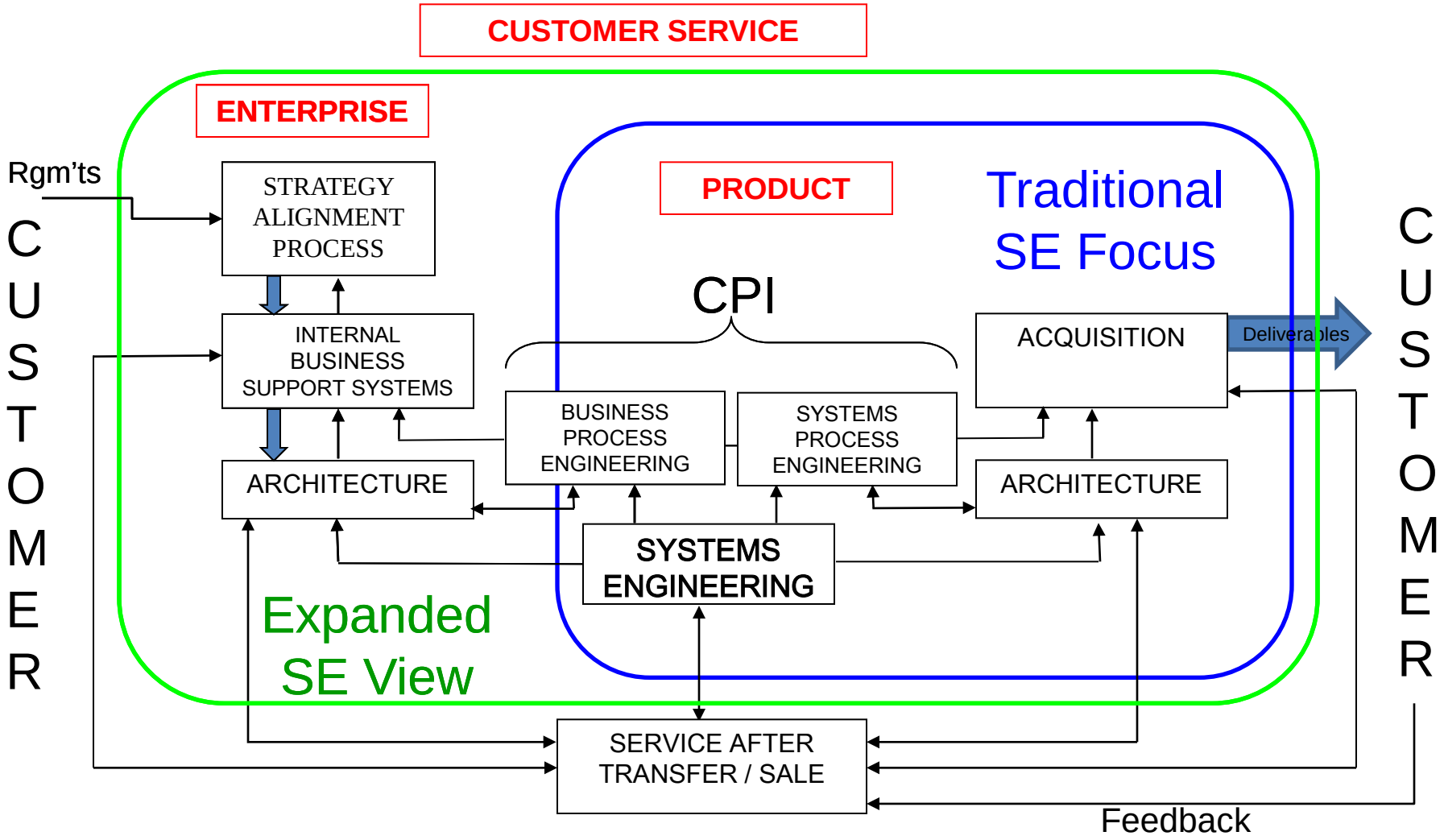
## Product, Enterprise & Customer Service View Model




**Integrated Systems Engineering: Looking Beyond Traditional Realms**

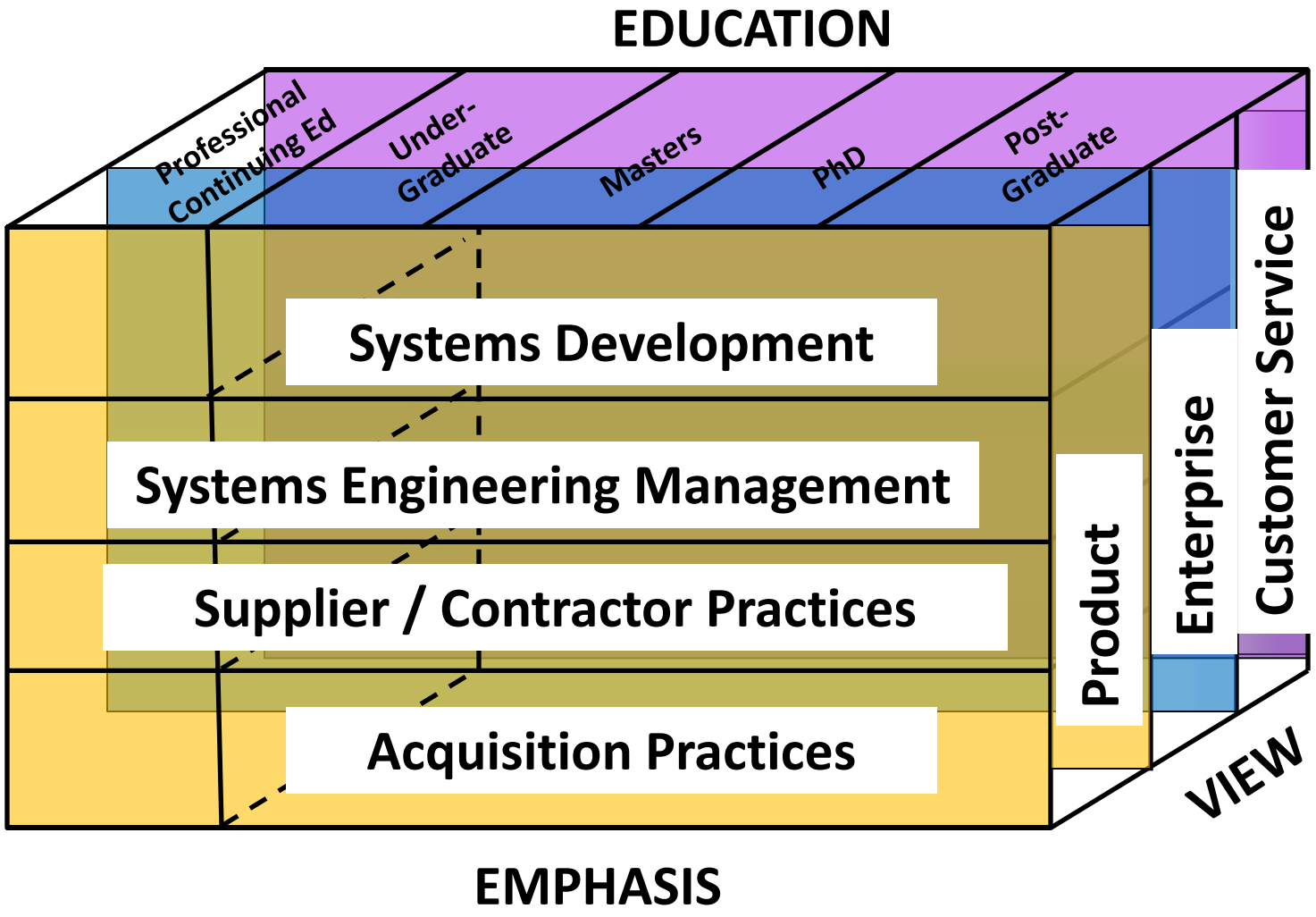
# Systems Engineering

## Product, Enterprise & Customer Service View Model




**Integrated Systems Engineering: Looking Beyond Traditional Realms**

# Competency Requirements Reference Cube



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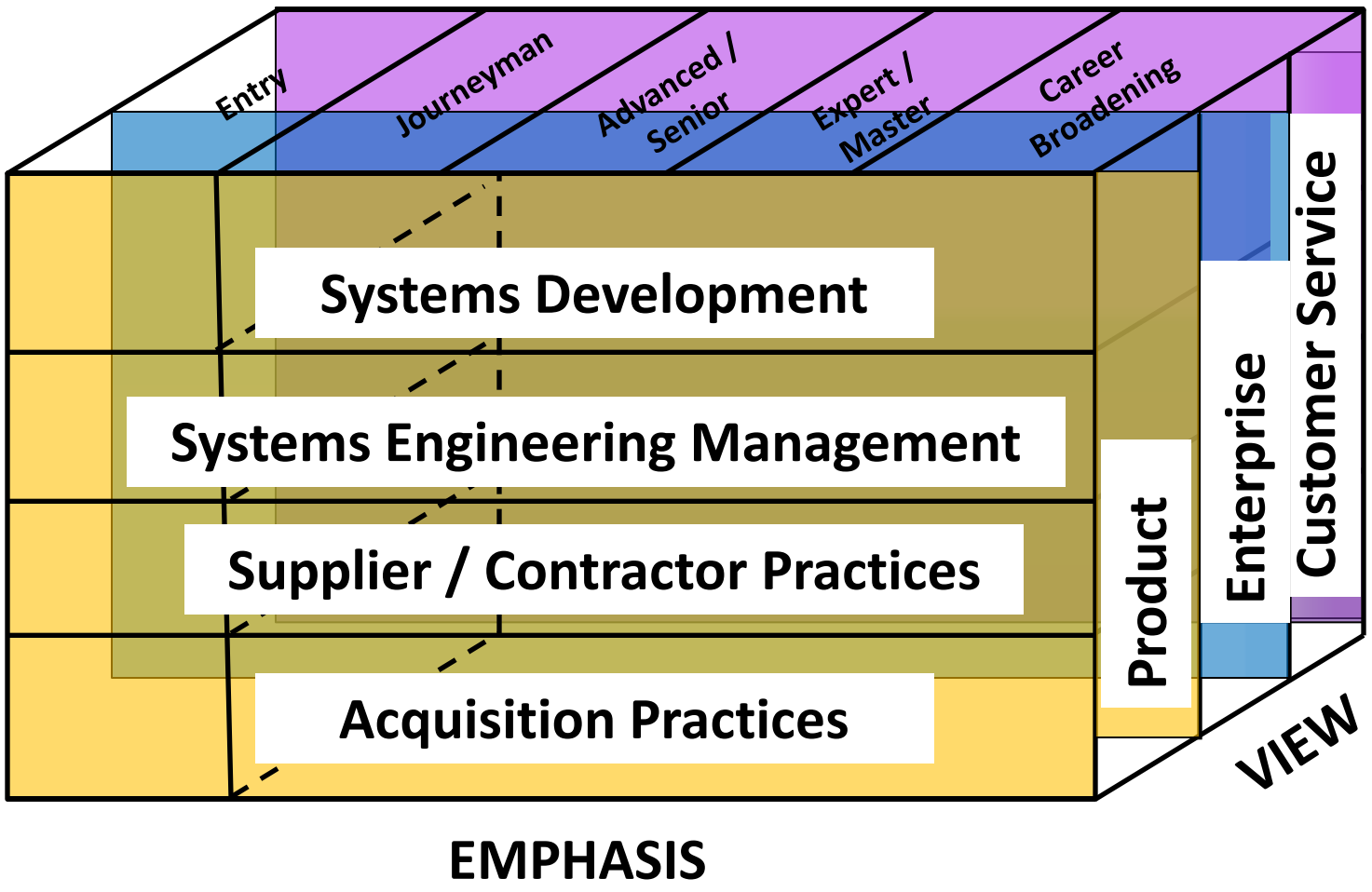
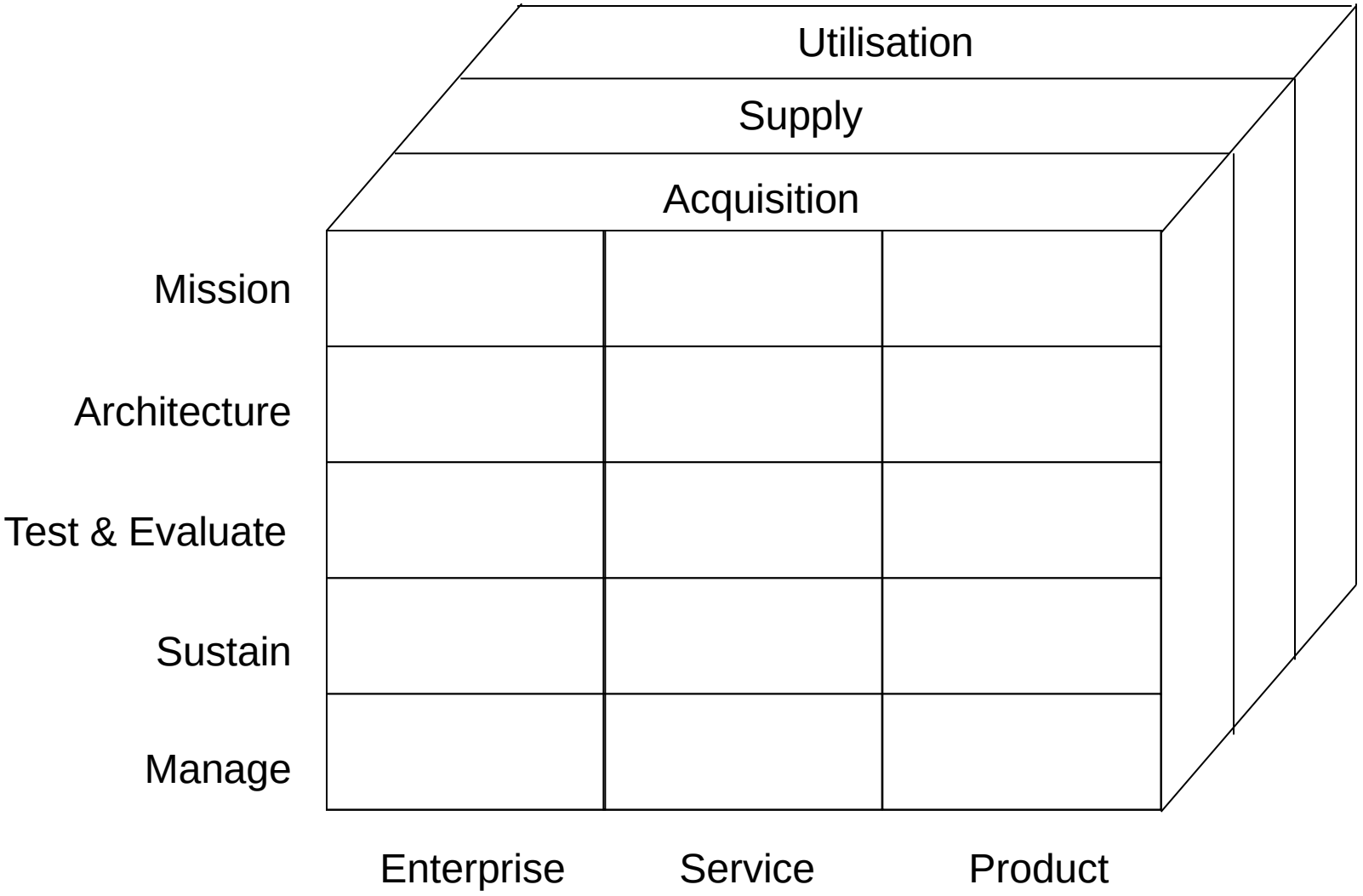
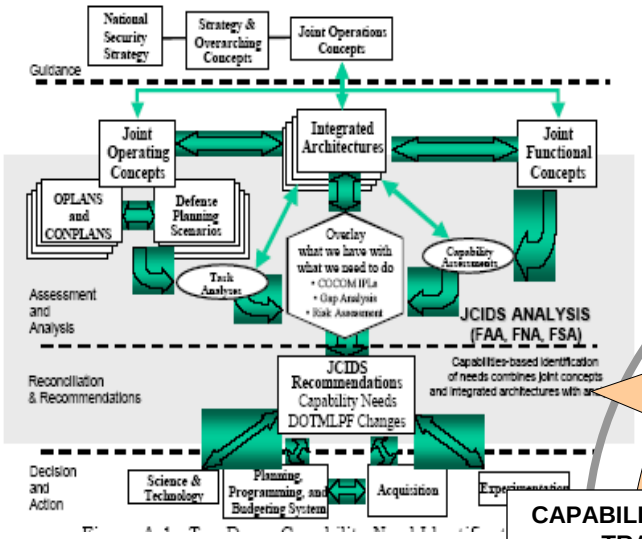


# Systems Engineering Roles



# Systematic Approach for Warfighting Capability

## JCIDS




## On-Going Operations

- Combatant Commands IPLs
- Operational Lessons
- Operational Need Statements

MROC PROCESS

FORCE CAPABILITY DEVELOPMENT

CAPABILITY FIELDING & TRANSITION

DOTMLPF REQUIREMENTS

PRIORITIZATION & RESOURCING

**Expeditionary Force Development System (JCAID PNT FWD)**

## PPBES

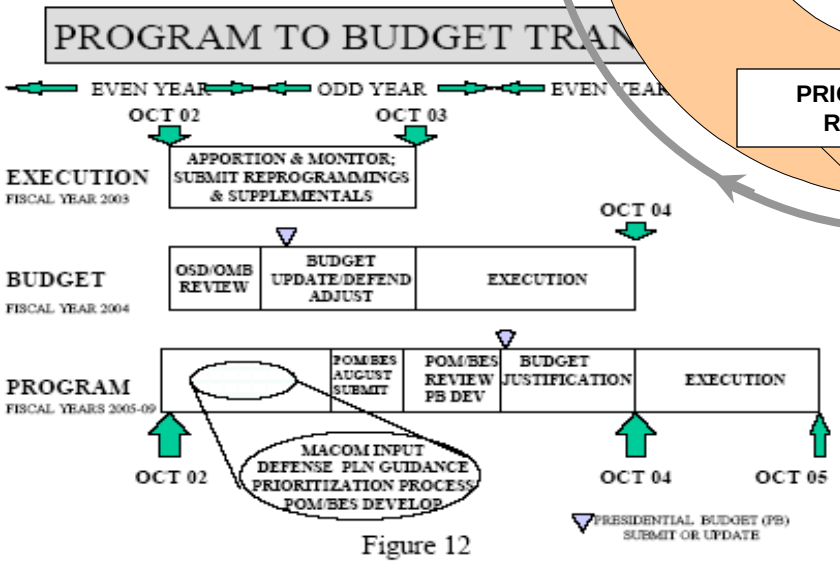
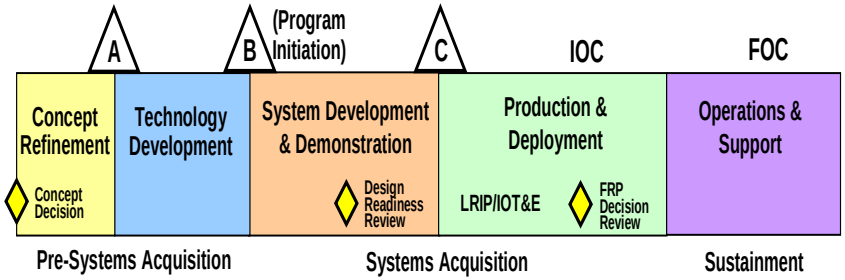



Figure 12

## Acquisition

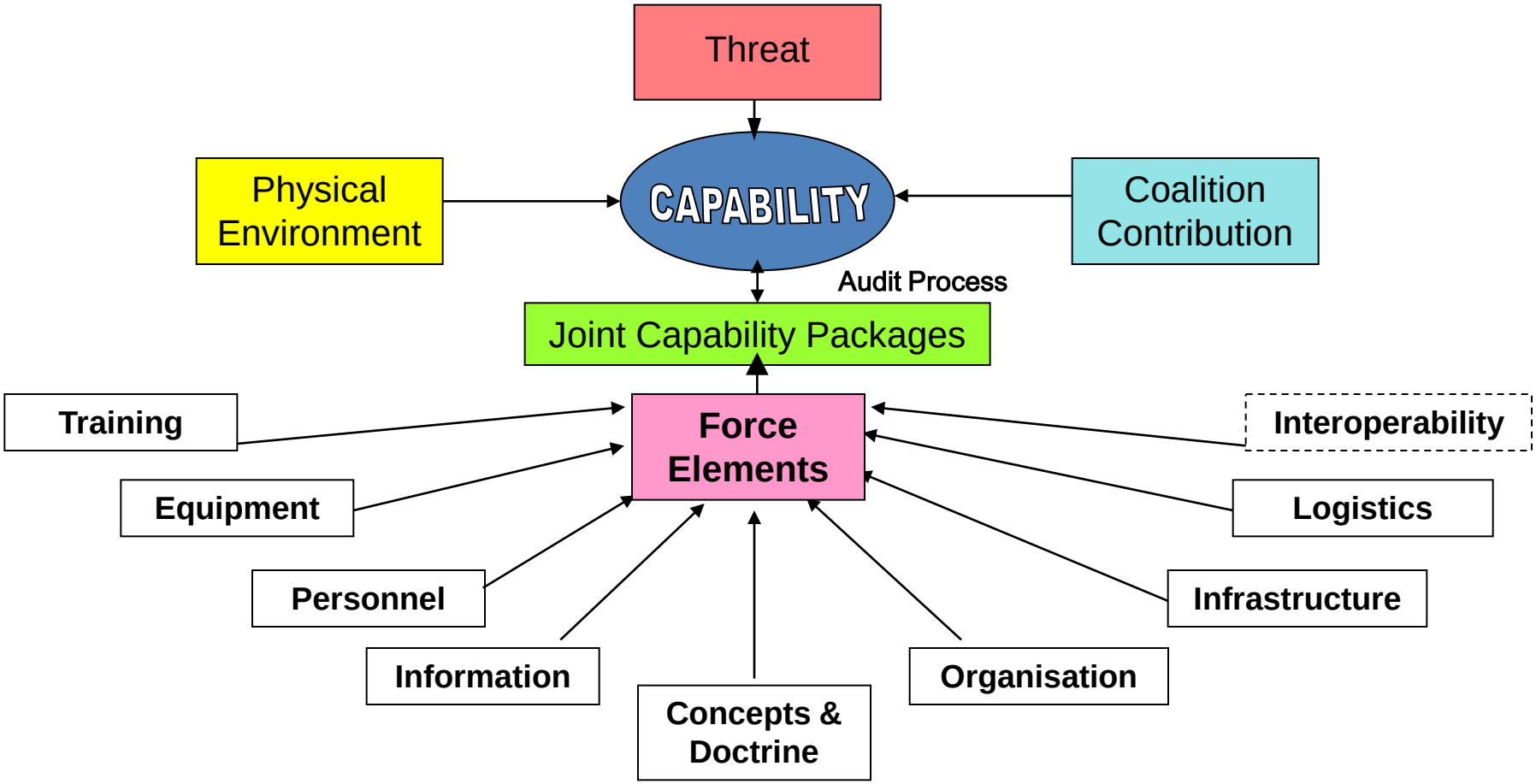
User Needs & Technology Opportunities

- *Process entry at Milestones A, B, or C*
- *Entrance criteria met before entering phase*
- *Evolutionary Acquisition or Single Step to Full Capability*



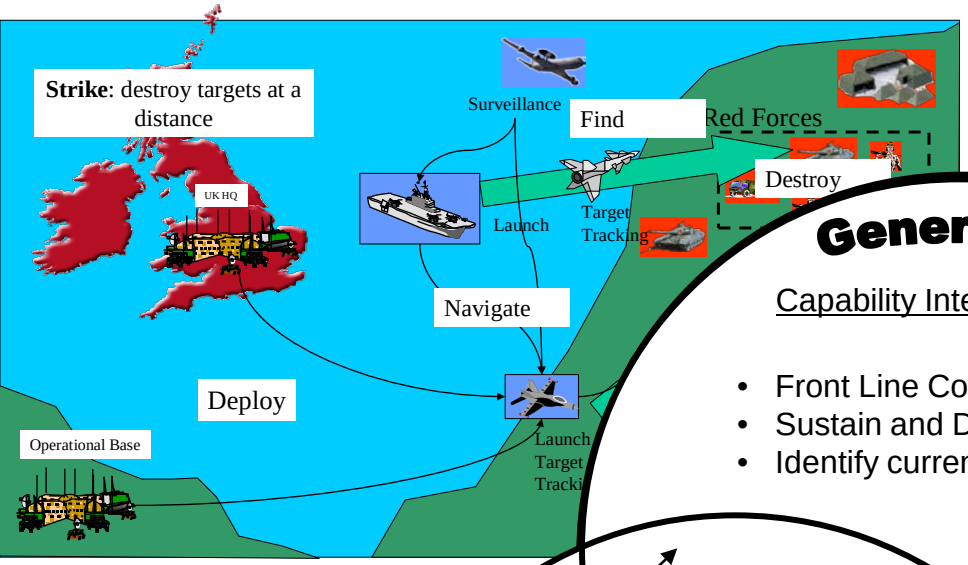
# Defence Capability

**“The enduring ability to generate a desired operational outcome or effect, relative to the threat, environment and the contributions of coalition partners”**

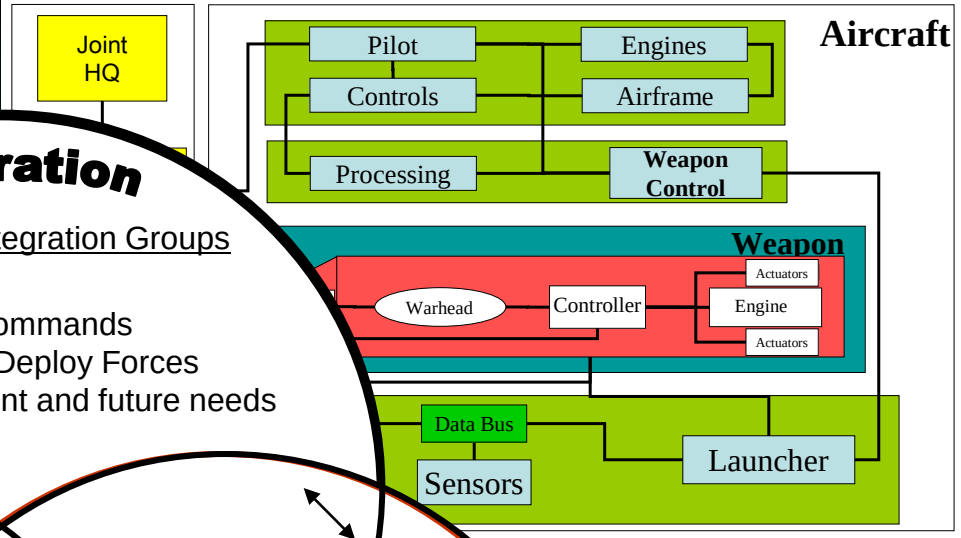



MOD Acquisition Operating Framework

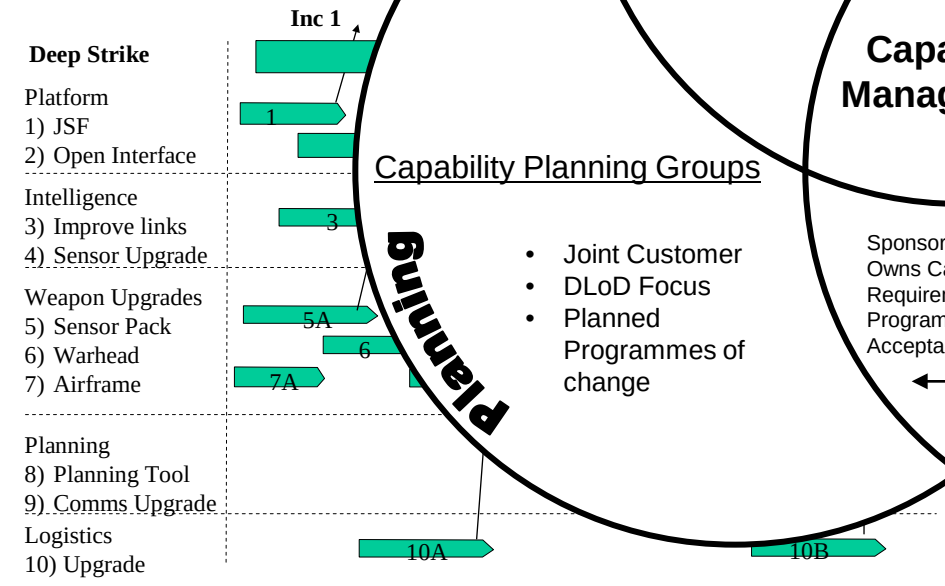
# Operational Scenarios




# Operational Interfaces




## Deep Strike U

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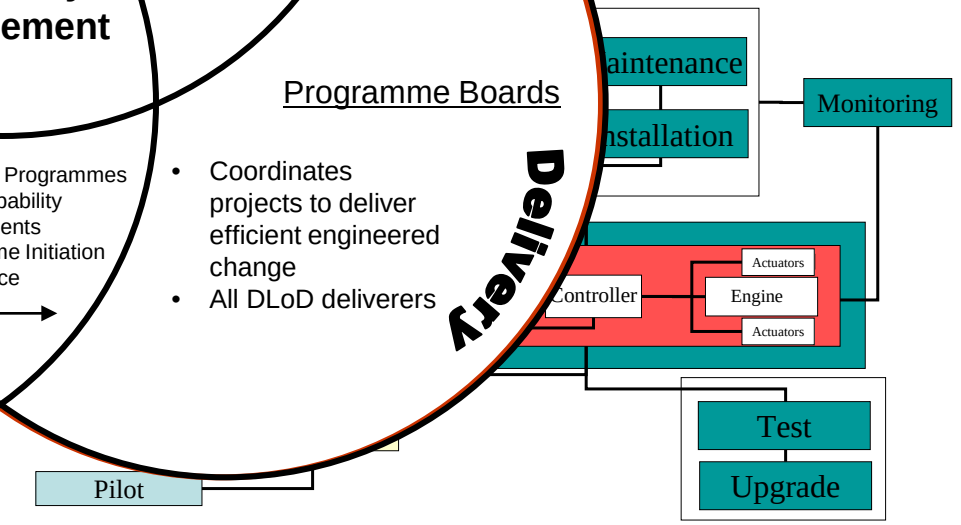
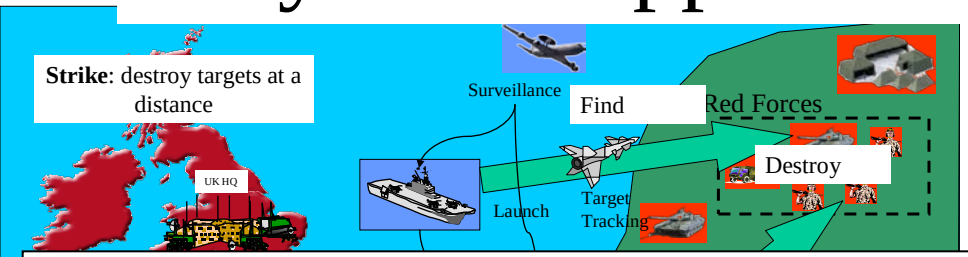
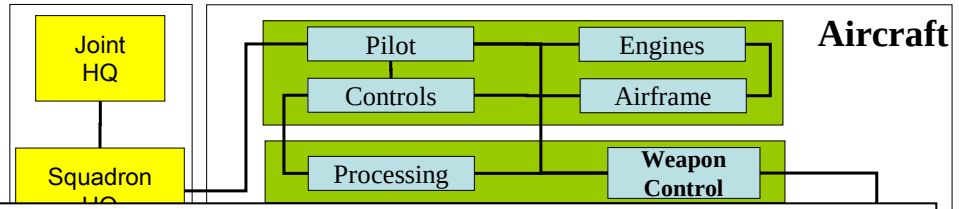


# A Systems Approach to Complex Problems




**Strategic Management**

Plan & Sustain
Organisation & Business

**Systems Engineering**

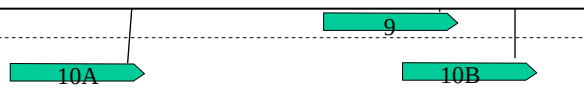
**Design**

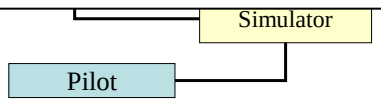
Develop & Integrate
Products & Services

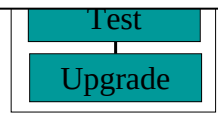
**Operations**

Create, Sustain
and execute Capability

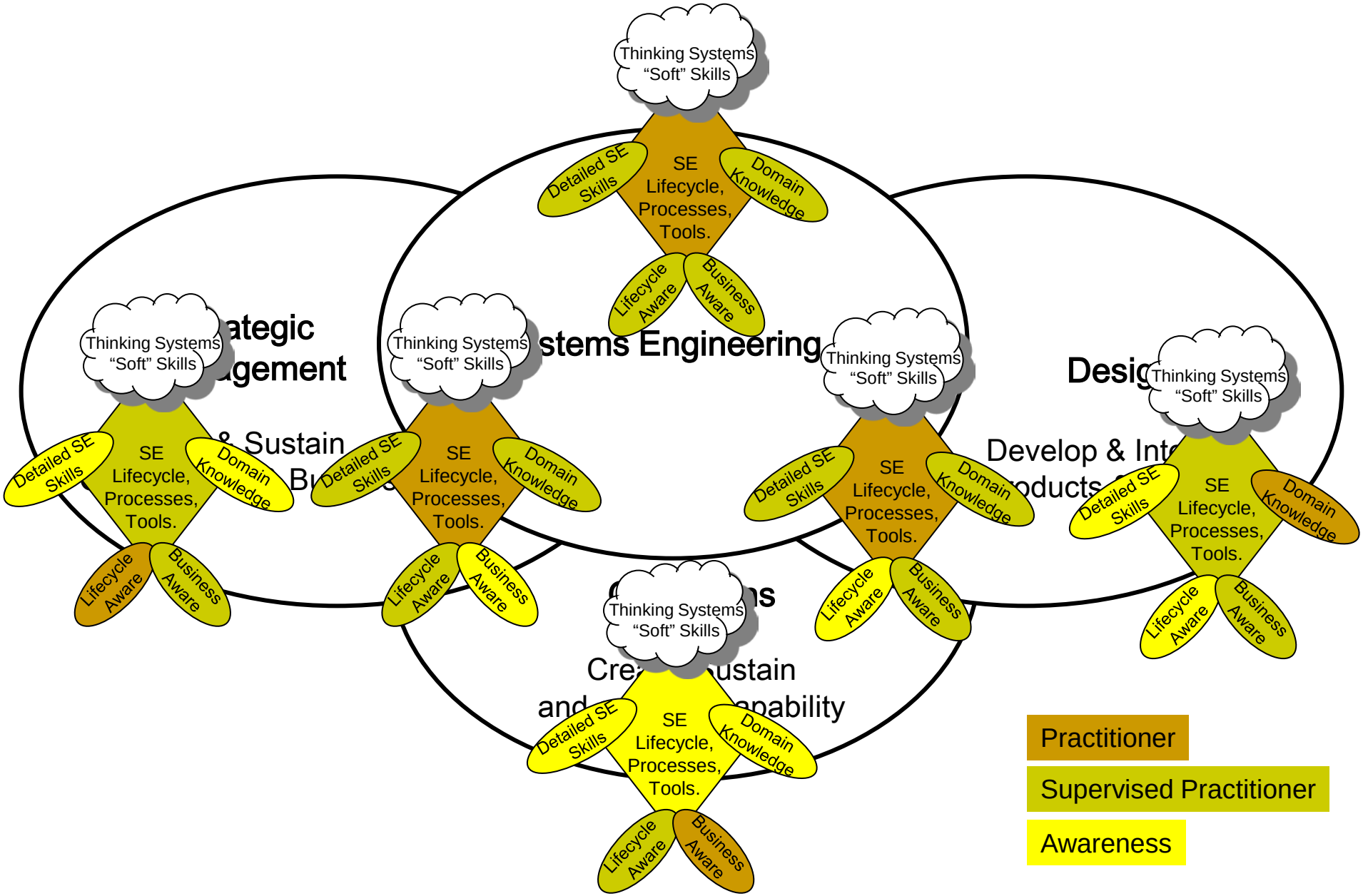
9) Comms Upgrade
Logistics
10) Upgrade



# Types of System People



# Questions

- Questions through Chair please
- I will share questions around the panel
- If you stick to asking questions, we will try to giving concise answer