Old Dog, New Tricks

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Presentation for the INCOSE
Symposium 2010 Chicago, IL USA

- The Capability Conundrum

- Systems Approaches to Capability Management

- Capability to the Solution Space

The Capability Conundrum

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The Problem Space

- Increasing Complexity in the Operational Environment
    - Greater integration across a number of disparate elements
    - Greater demand for flexible and agile solutions to meet changing Operational needs

- Greater Focus on the Outcome of Systems and Services
    - Operational Effectiveness vs "Impact to Ourselves"

- Drive for Acquisition and Management of Capability
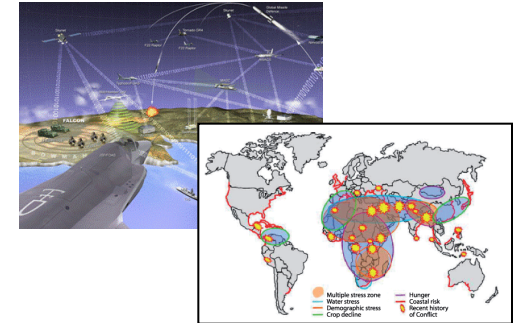
Deaths from hospital blunders soar 60% in two years as NHS staff 'abandon quality of care to chase targets'
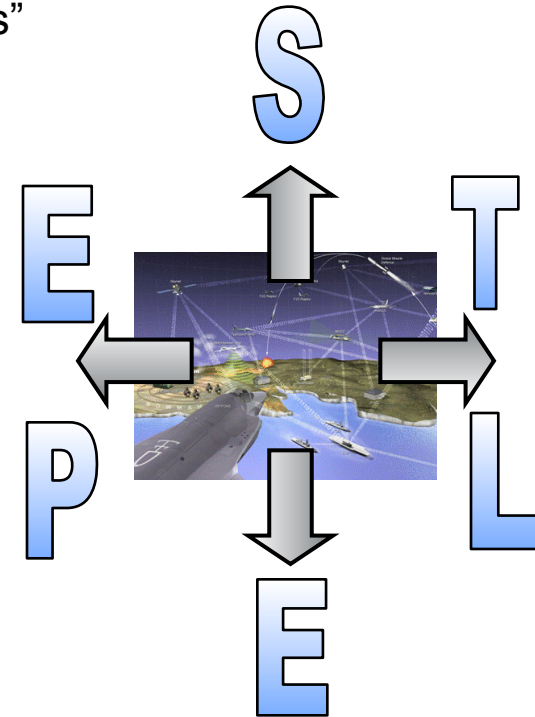
Terminal 5 chaos continues at Heathrow

The Capability Combination

- It's not just about Equipment…

- Capability realised through integration of multiple elements (Lines of Development)
  - **P**eople (including Training and Organisational structures)
  - **P**rocess (including Legislation, Strategy, Management Information)
  - **E**quipment & Technology
  - **I**nfrastructure
  - **S**ustainment

- Elements must be individually managed and co-ordinated together to ensure that the required Capabilities are achieved
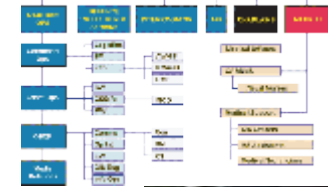
Putting it into Context

- Capability is hard to quantify and is often enduring…
    - "Deliver an "effective" health care system to all UK citizens"
    - "Maintain safety and security for the general public"

- ..therefore Capability-based decisions must be considered within the wider context of their external influences
    - **Political** – national political system and government policies
    - **Economic** – trends, inflation, business cycles
    - **Social** – demand for safety and security, changing expectations
    - **Technological** – innovation, obsolescence
    - **Legal** – competition, international laws, health & safety
    - **Environmental** – legislation, energy consumption, sustainability

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Finding the Optimal Solution

- "In an ideal world, with unlimited resources…"

- Capability needs to be provided within a number of constraints:
  - Initial and Through Life Cost
  - Capability
  - Time
  - PESTLE Influences
  - Industry
  - …

- Requires the Enterprise to make Trades between:
  - Elements of the Capability (Lines of Development)
 - Capabilities themselves

What is Required?

- A Systems Approach to Capability Management enables…

  - …holistic, through-life consideration of multi-faceted impacts

  - …a structured approach to enable the exploration of the solution space within its wider context

  - …inclusion of all contributing elements to Capability and their associated impacts from a number of perspectives

Systems Approaches to Capability Management

Addressing the Challenge

- BAE Systems has developed TRAiDE™ as a means to support Capability based decision making
  - Based on sound architectural principles
  - Enables a structured approach to Capability Management

- Underpinned by the availability of high-quality , timely and coherent data
  - Need for structured approach for Information Management
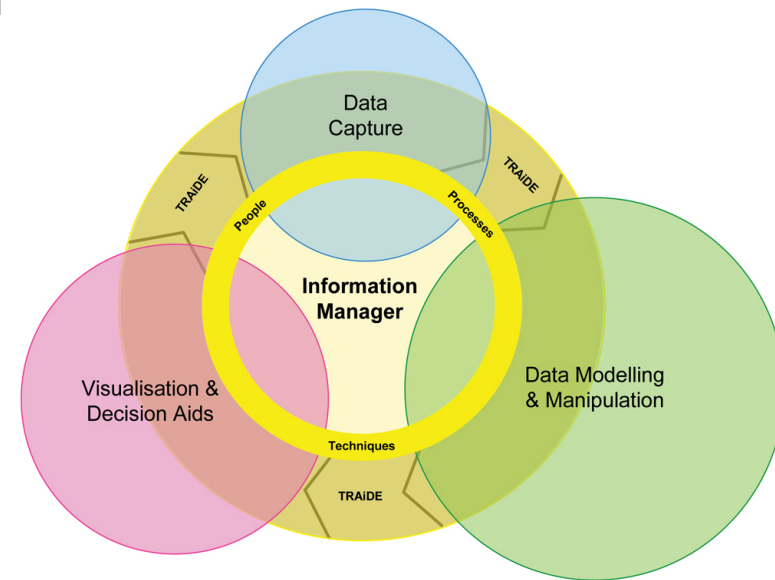
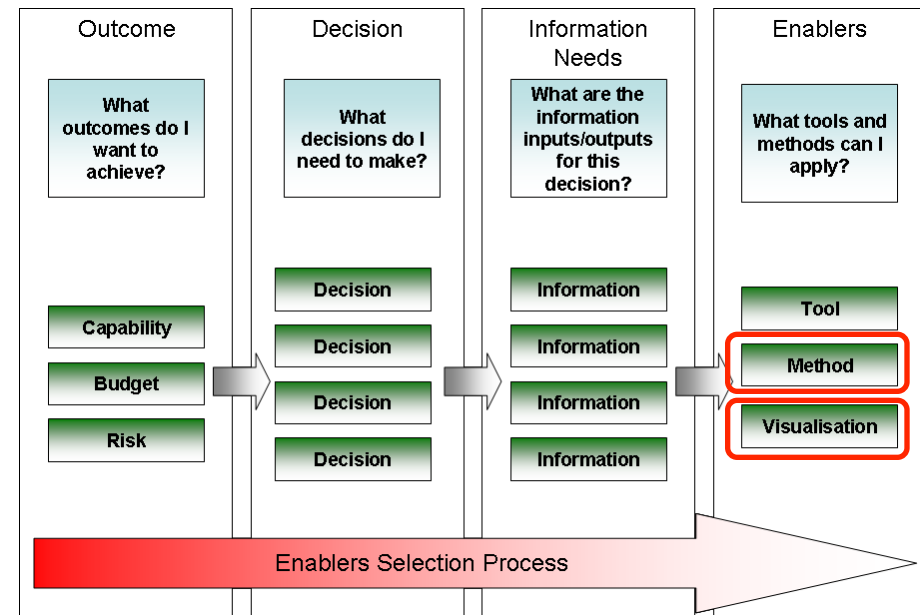

TRAiDE™ – TLCM Robust Acquisition inclusive Decision Environment

Principles of the TRAiDE Approach

- Analytical Techniques
  - Provide understanding of the Context
  - Consideration of Multiple Perspectives
  - Information appropriately fused to provide knowledge

- Support to Decision Making
  - Visualisation
  - Aggregation
  - Prioritisation
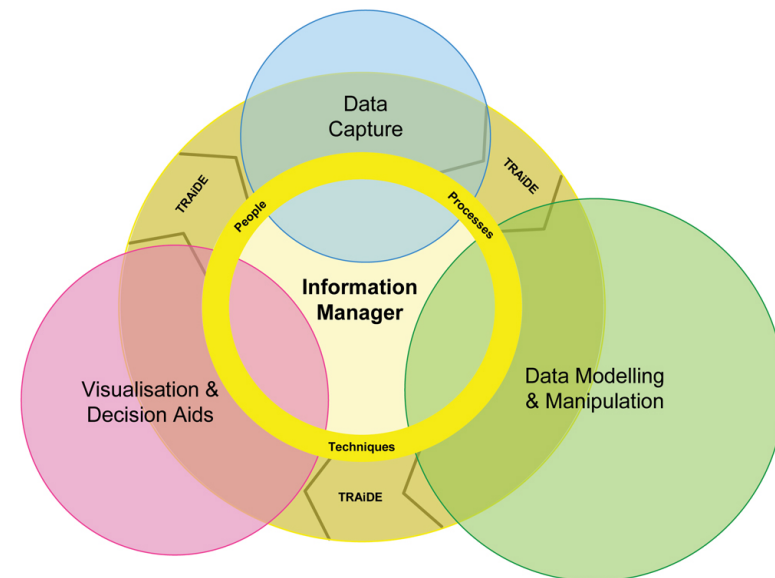
Selecting the Right Enablers…
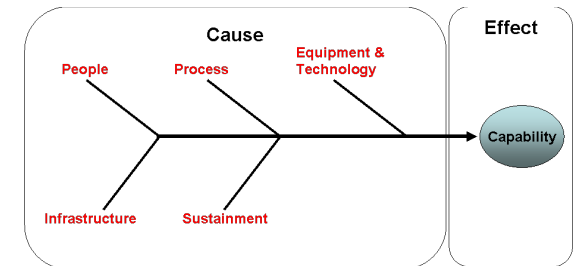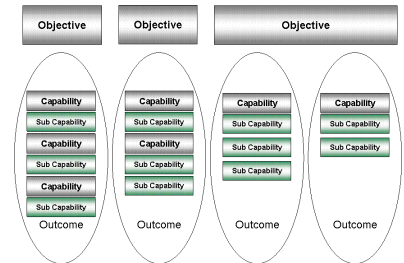
- "Just Enough" Philosophy
  - Complexity of Methodologies
  - Level of Detail
  - Focus of Effort on Priority Areas

- Outcome Driven
  - Aligned with Enterprise Priorities
  - Within constraints and boundaries
  - Resource Availability (Time, Skills, Data etc)

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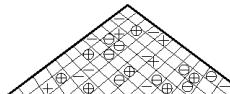Presentation for the INCOSE Symposium 2010 Chicago, IL USA

Method Selection Examples

- What are the set of Capabilities that I need to meet the desired outcome?
  - And how should I structure my Enterprise to meet them?

- What are the systems that contribute to the Capability?
  - And how are they related?

- How well does each system contribute to the Capability?
 - And where are the opportunities for optimisation?

Affinity Diagrams

- Traditionally…
    - Used to structure ideas in brainstorming activities

- In a Capability Context…
    - Enables partitioning of enterprise objectives into a set of Operational Capabilities
    - Enables Organisational Structures to be aligned to the Capability Needs
    - Enables articulation of the interdependencies between Capabilities and Organisations
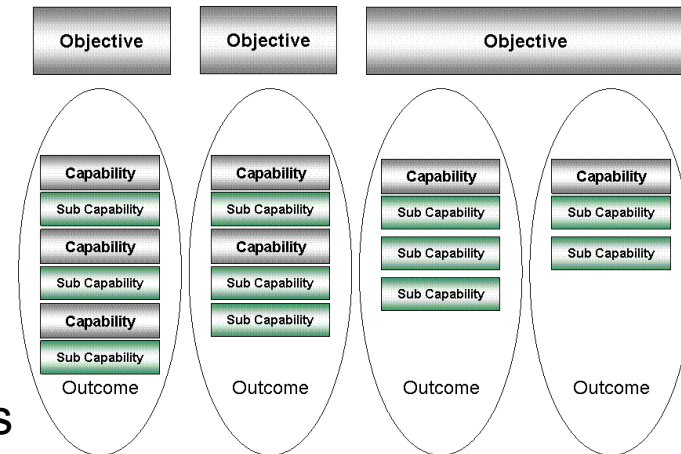
Ishikawa Fishbone

- Traditionally…
    - Used to identify potential quality defects in systems

- In a Capability Context…
    - Can be used to identify the contributing elements of the Capability
    - Can be used to articulate the "ripple effect" of subsystem changes on the overarching Capability
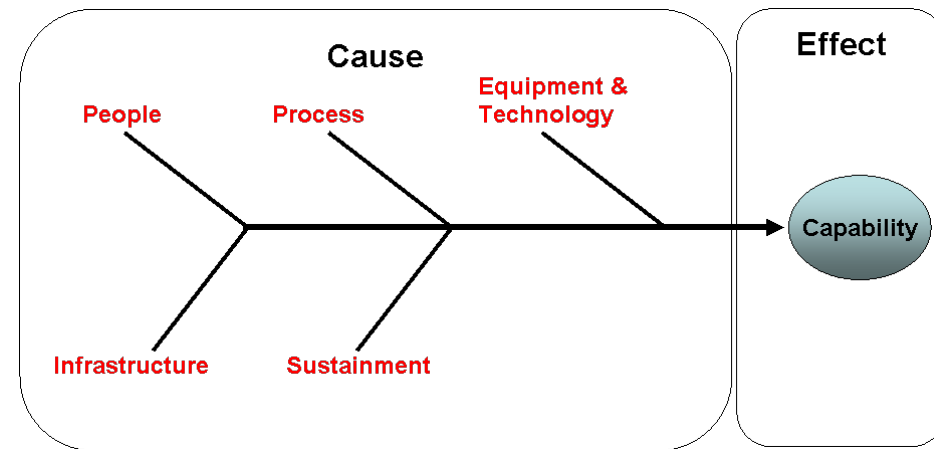
Quality Function Deployment (QFD) Matrices

- Traditionally…
  - Used to capture user requirements and specify these against how they are to be achieved

- In a Capability Context…
  - Can be used to articulate the contribution of Systems to Capabilities
  - Enables identification of cross-Capability contributions of Systems
  - Supports "Trading" across the Capabilities and Systems
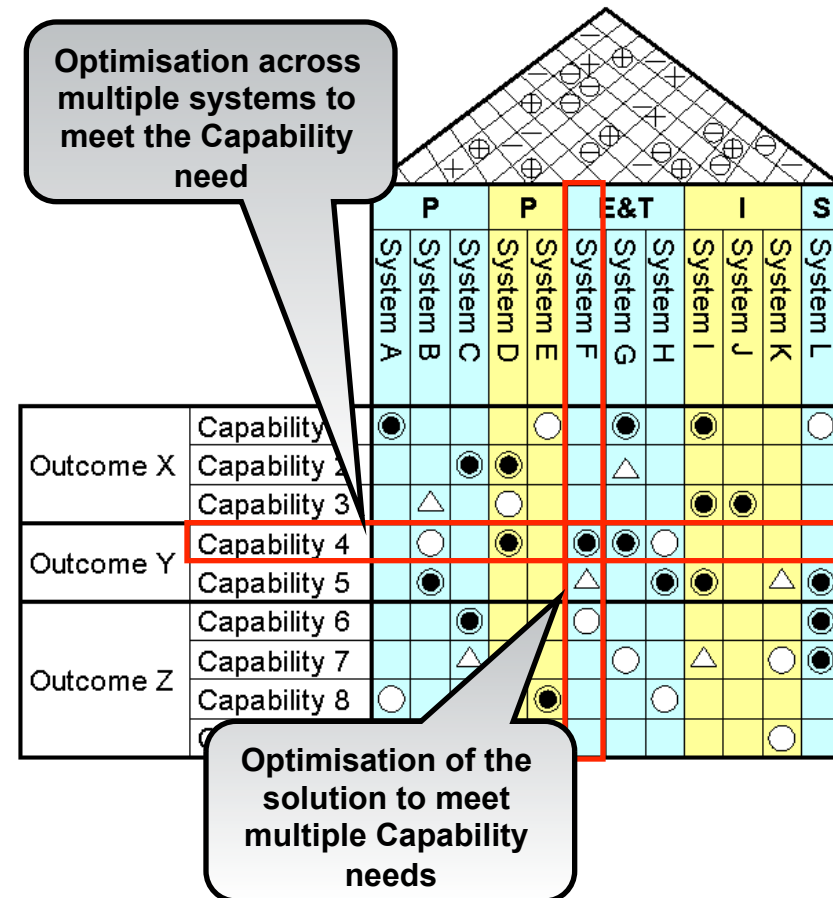
Visualisation Selection Examples

- ## What is the relationship between elements within the Capability?

  - ### And what is the cause and effect relationship between these elements?

- ## What are the relationships between the interrelated elements through time?

  - ### And what is the impact of changes of one or more elements?

- ## What are the stakeholder dependencies within the Enterprise?

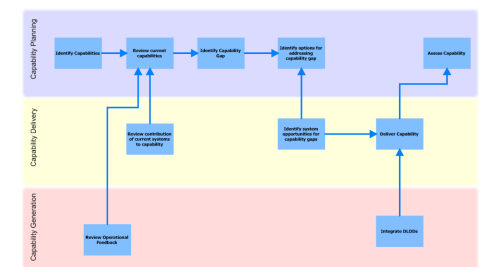 - ### And where are the critical interfaces and relationships?
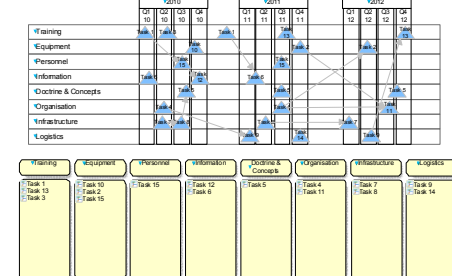
Combining Visualisations

- Fusing Visualisations enables multiple perspectives to be considered

- Supports "What If" type analysis to show direct and indirect impacts of baseline changes

- Imperative that "Just Enough" principles are adhered to in order to prevent too much complexity within the visualisation

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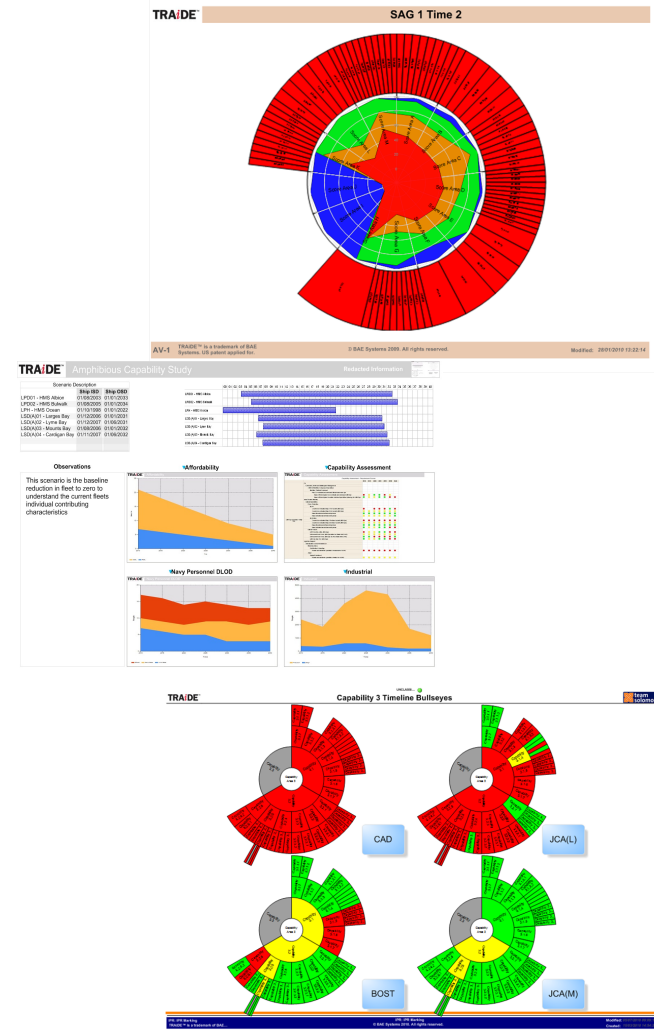
From Capability to the Solution Space

What's New?

- Traditionally…System and Service requirements are developed by the customer for delivery by Industry
    - Well defined set of processes with clear boundaries on roles and responsibilities
   - But…restricts the capacity for innovation and agility which are key factors when delivering solutions within the ever changing operational context

- Systems Engineering Approaches equally applicable when developing solutions with Capability-based focus
    - Structured approach to assessment of solution options within the wider context
    - Enables consideration of multiple perspectives
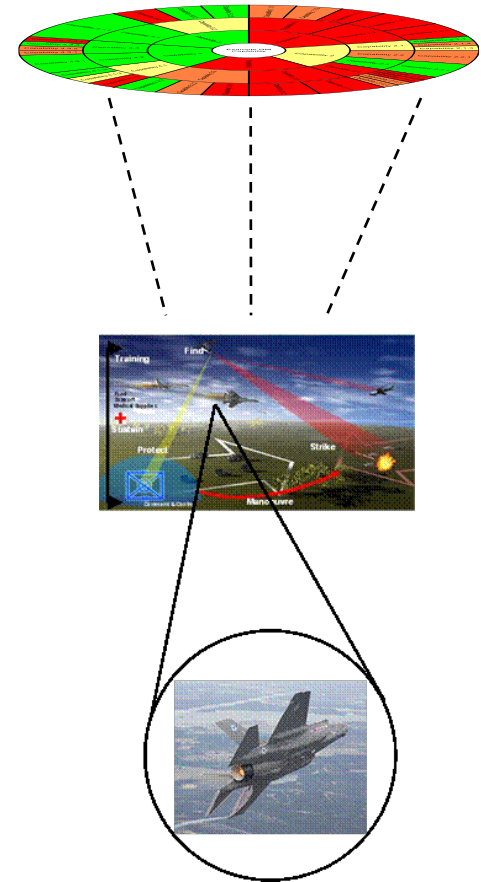   - Common Framework for greater collaboration
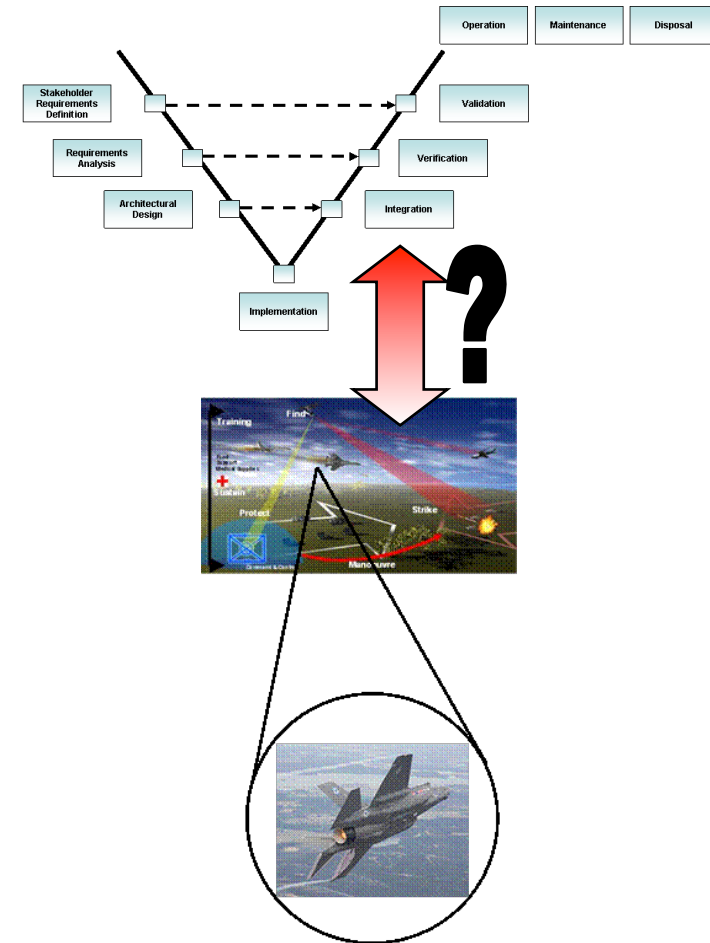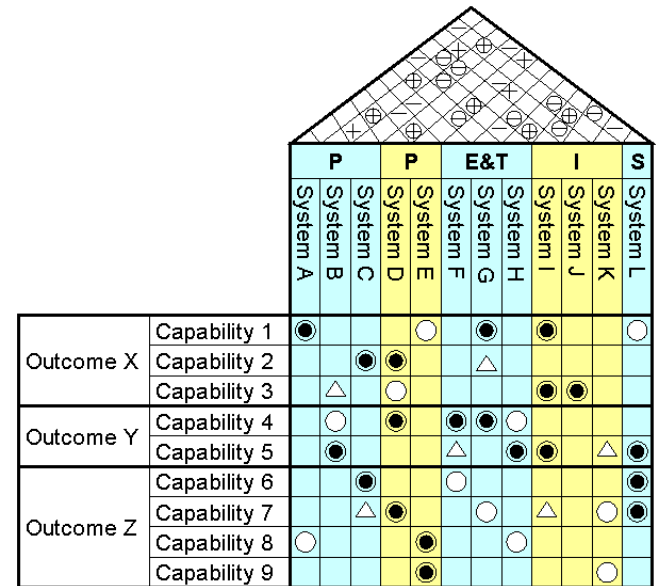
The "V" Diagram
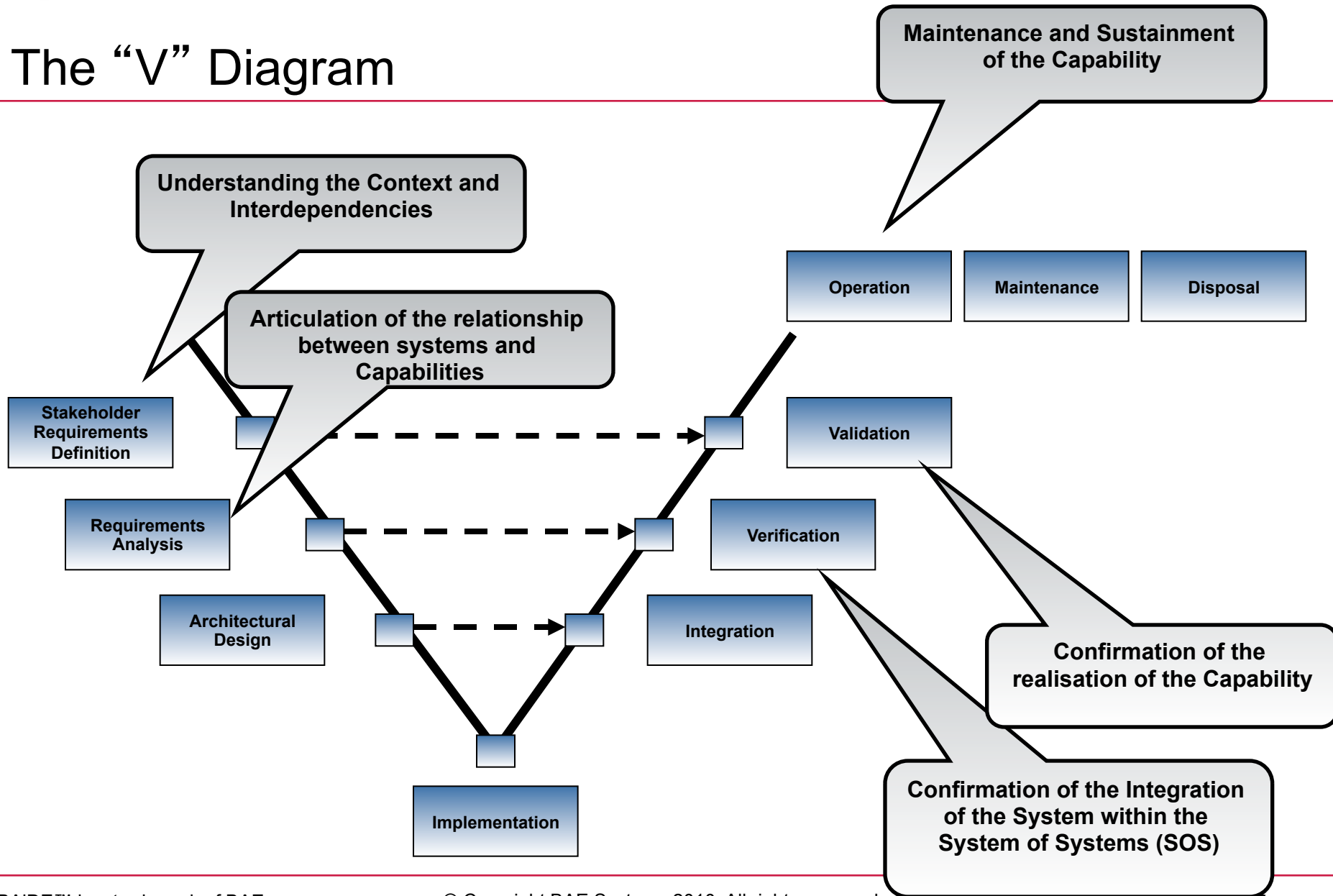
Stakeholder Requirements Definition

- Mapping of the System to the overarching Capabilities to which it contributes
  - The System may span Capability Areas which can lead to conflicting requirements

- Enables the identification of the direct and indirect stakeholders of the system
  - Related Systems
  - Related Capabilities
  - Related Organisations

- Enables early establishment of working relationships between other contributors to the Capability

- Ensures that a common baseline of assumptions and dependencies is understood by all parties

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Requirements Analysis

- Considering within a Capability Context will lead to broader and more "woolly" requirements
  - Multiple Solution Options to meet the same Capability needs
  - Requires articulation of the inter and intra Capability interdependencies

- Using the Quality Function Deployment Matrix…
  - Enables identification of the critical components to realising the Capability
  - Supports "What If?" type analysis to find the optimal solution within the external constraints and boundaries
  - Supports prioritisation of system requirements based on higher level needs of organisation

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Verification and Validation

- Verification – "you built the product right"
    - Integration between elements to ensure interoperability
    - Integration should be both inter and intra element
    - Maturity and Readiness of all contributors is a key factor in the interoperability of all elements

- Validation – "you built the right product"
    - Confirmation of the realisation of the Capability and achievement of the desired outcome within a set of defined scenarios
    - Scenarios will be linked to the higher level enterprise objectives and external bounds
    - Use of Operational Analysis, Simulation and Experimentation is a key enabler
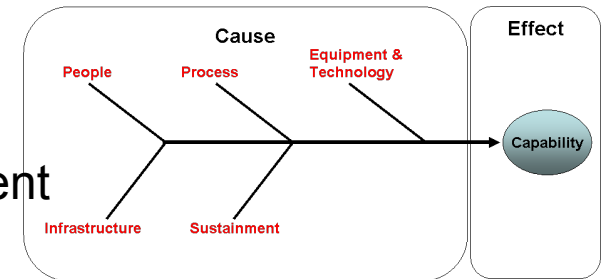
Maintenance, Sustainment and Disposal

- **Sustainment of System within Capability Context throughout its life**
  - Against a backdrop of changing external factors
  - Each may spawn new "Capability lifecycle" for system

- **Disposal occurs when…**
  - …system is replaced for practical reasons (e.g. cost of maintaining legacy systems)
    - Management of the impact of the change on interfacing systems and/or Capabilities
  - …the Capability is retired due to context changes (e.g. policy changes, priorities etc)
    - Enables reuse of released systems for:
      - New/Changing Capabilities
      - Better realisation of extant Capabilities through different configuration

Changes to Context

Retirement of Systems

Introduction of Systems

Changes to System
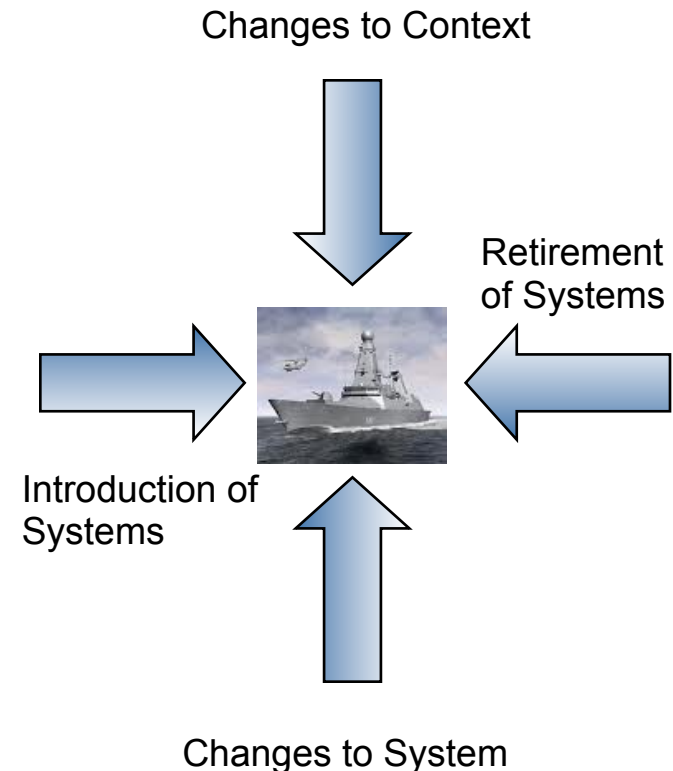
Summary

- Capability Management is a complex Systems of Systems Engineering problem against a backdrop of changing external influences

- The complexity of the problem must be overcome through intuitive visualisations and the appropriate aggregation of data to enable acquisition and management decisions to be made

- Systems Engineering Approaches support the structuring and consideration of the contributing elements of Capability from a number of different perspectives

Questions?

Sam – aged 13½, that's 95 in dog years!