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**Defence requires Enterprise-level Innovation:  
Using a Systems Approach to secure superior Value from Ideas**

**Prof Mike Wilkinson, Niteworks Technical Director  
Simon Jewell, Niteworks Managing Director**

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# Introduction and approach

- ▼ Aims of the paper
  - Understand how innovation works currently in UK Defence
  - Develop proposals for how it might be improved
- ▼ Contributions to the paper
  - Niteworks Continuous Capability Evolution (CCE) white paper
  - Extensive literature survey
  - Experience from Niteworks and its projects
  - Primary research conducted with the Niteworks partnership
- ▼ Adopting a systems perspective
  - Identify elements of an ‘innovation landscape’
  - Synthesise a set of innovation models
  - Map models to constructs to Defence functions
  - Consider system dynamics as end-to-end innovation journeys
  - Develop insights on what works and how to improve

# What exactly do we mean by innovation?

- ▼ Innovation is a term that defies simple definition!
- ▼ Baregheh et al (2009) combine over 60 definitions to get
  - ▼ Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, services or processes, in order to advance, complete and differentiate themselves in their marketplace
- ▼ UK MOD Strategic Defence and Security Review (2015) says
  - ▼ Innovation is generating ideas and putting them into practice to overcome challenges and exploit opportunities
- ▼ Schumpeter (1934) says
  - ▼ Innovation is possible...without invention and invention does not necessarily induce innovation
- ▼ Our survey shows that **novelty**, **change** and the delivery of **value** are recurrent themes, so we say
  - ▼ Innovation is gaining significant value from the exploitation of novelty and change, or...
  - ▼ ...superior value from ideas

Business Perspective

Problem-Solving Perspective

Invention versus Innovation

Why Innovate? Perspective

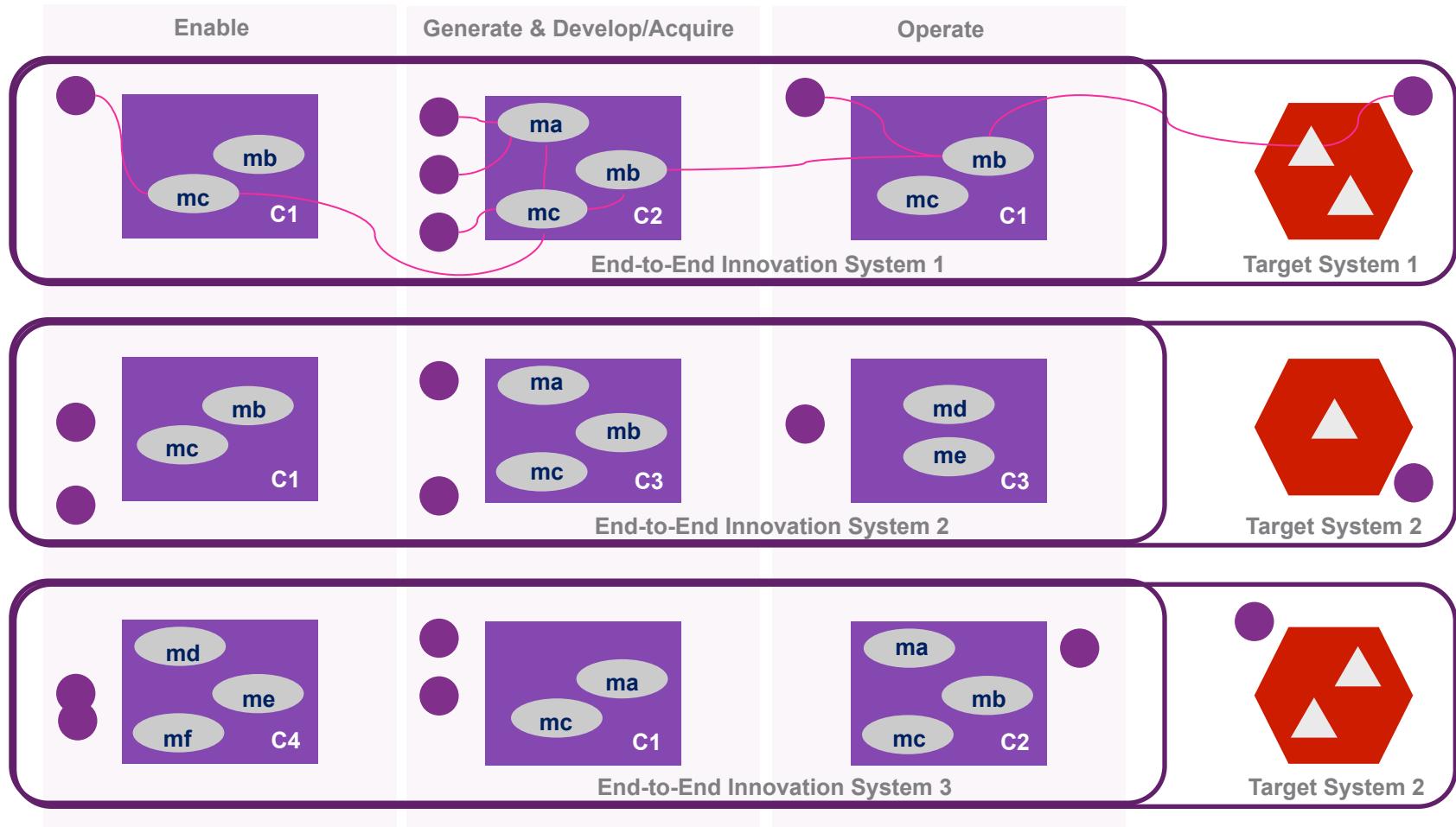
# The history of Systems Engineering and innovation

- ▼ Early thinking considered Traditional SE and innovation
  - ▼ Same basic process, different perspectives (Walden 1998)
- ▼ Innovation can occur at different levels, eg societal
  - ▼ Potential to use SSM (Stajnko and Doukas 2001)
- ▼ Specific 'innovation system'
  - ▼ Target (system) of innovation, target (system environment) and innovation system (Schindel 2013)
- ▼ System evolution and agility in innovation are related
  - ▼ System configurations settled at different times, eg design time, during operations (Schindel 2015)

# The UK Defence context



# Features of the Enterprise innovation landscape



# Types of innovation models

- ▼ Analysis of the literature and experience from Niteworks found several possible ways of classifying innovation models
  - ▼ Operating model characteristics Five 'generations' from Technology Push through to System Integration and Networking (Rothwell 2002)
- ▼ Object of innovation
  - ▼ Four box model with technology and business model dimensions (Pisano 2015)
  - ▼ Commercial sector dimensions (Keeley et al 2013)
  - ▼ Defence Lines of Development
- ▼ Innovation mechanisms
  - ▼ Enterprise modelling breakdown (governance, processes, etc)
  - ▼ Experience from Niteworks (CCE)

# Synthesised innovation models

- ▼ Fundamental & applied research
- ▼ Technology incubation
- ▼ Spin-out
- ▼ Innovation brokering
- ▼ Product development
- ▼ Bespoke development
- ▼ Problem solving
- ▼ Collaborative problem solving
- ▼ Manufacturing
- ▼ Capability
- ▼ Continuous
- ▼ Operational

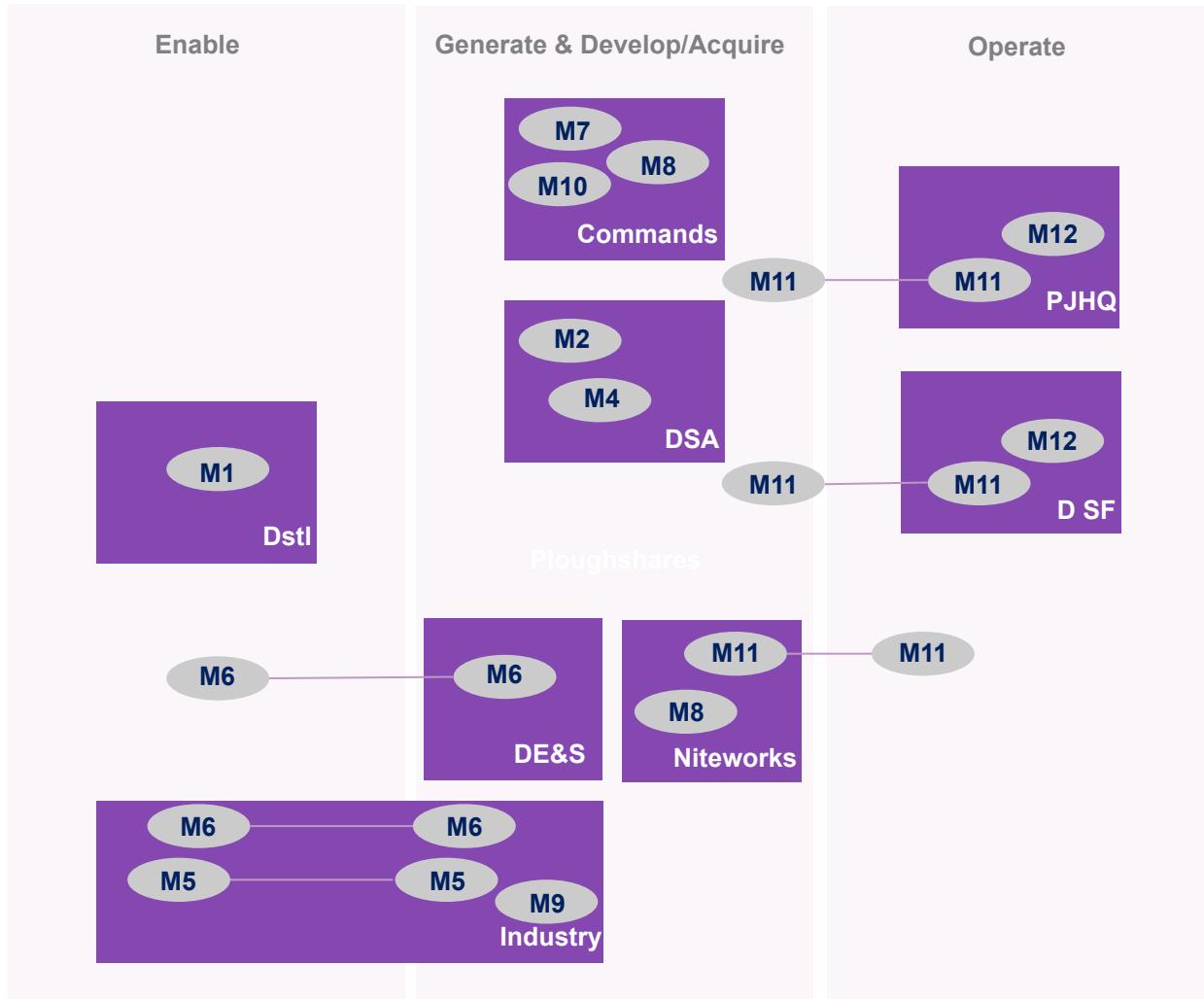
# Synthesised innovation models - examples

- ▼ Fundamental & applied research
- ▼ Technology incubation
- ▼ Spin-out
- ▼ Innovation brokering
- ▼ Product development
- ▼ Bespoke development
- ▼ Problem solving
- ▼ Manufacturing
- ▼ Operational
- ▼ Collaborative problem solving
  - ▼ Provides a collaborative environment bringing together problem owners and solution providers
- ▼ Capability
  - ▼ Searches for novel ways of integrating elements of capability to deliver overall capability outcomes – pan DLOD
- ▼ Continuous
  - ▼ Incorporates innovation support directly into day-to-day operations, linking users, acquisition and system/service integration via an embedded innovation hub (cf CCE)

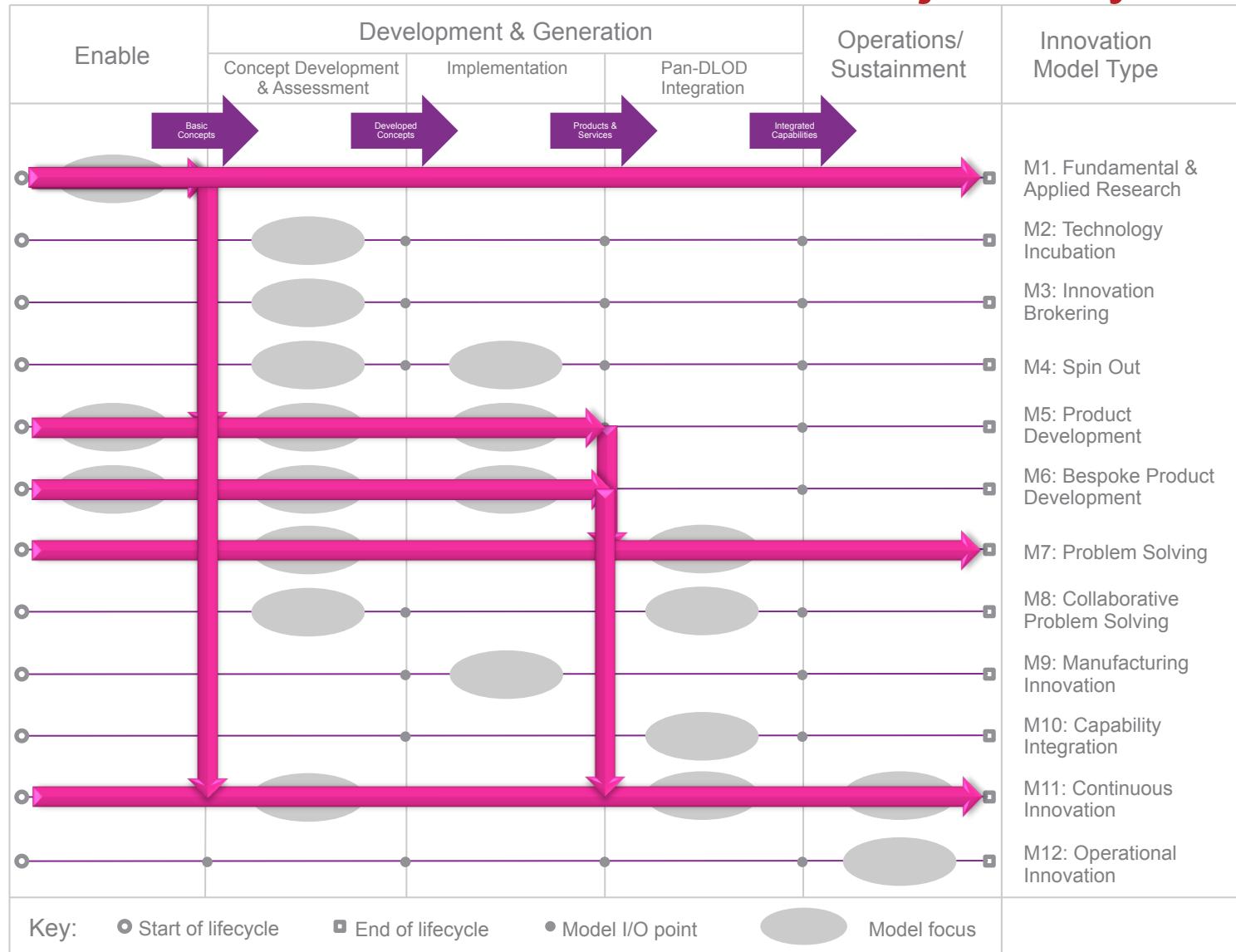
# Synthesised innovation models

1. Fundamental & applied research
2. Technology incubation
3. Spin-out
4. Innovation brokering
5. Product development
6. Bespoke development
7. Problem solving
8. Collaborative problem solving
9. Manufacturing
10. Capability integration
11. Continuous
12. Operational

# COG mapping: models to constructs to DOM



# Innovation models and end-to-end journeys



# Preliminary observations and insights

- ▶ Temporal and dynamic aspects
  - ▶ Time horizon for change drives model applicability
- ▶ Coverage of innovation needs
  - ▶ Novelty required across whole of end-to-end lifecycle
  - ▶ Not enough attention paid to 'right hand side' of lifecycle
- ▶ Applicability of innovation models
  - ▶ Each model has its own footprint (mostly unique)
- ▶ Innovation systems coherence
  - ▶ Defence innovation system has not been designed
  - ▶ End-to-end coherence not articulated
  - ▶ Innovation value chain unclear
  - ▶ Innovation system not actively managed

# Deriving a way forward for Defence innovation

- ▼ Much can be learned from studying Defence innovation from a systems perspective
- ▼ Individual constructs give detailed insights into 'how to do it'
- ▼ General principles
  - ▼ Consider innovation at the Enterprise level [complexity]
  - ▼ Design the system holistically [efficacy and integrity]
  - ▼ Design with dynamics in mind [fast/slow spin applicability]
  - ▼ Ensure constructs contribute to the value chain [coherence]
  - ▼ Manage innovation initiatives as change programme [success]
  - ▼ Develop as-is and to-be architectures [comms and consensus]
  - ▼ Provide appropriate end-to-end resource [balance]
  - ▼ Implement iterative refinement [enterprise behaviours]

