



# A Concept for the Modelling and Simulation of Complex Urban Environments

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Matt Smith

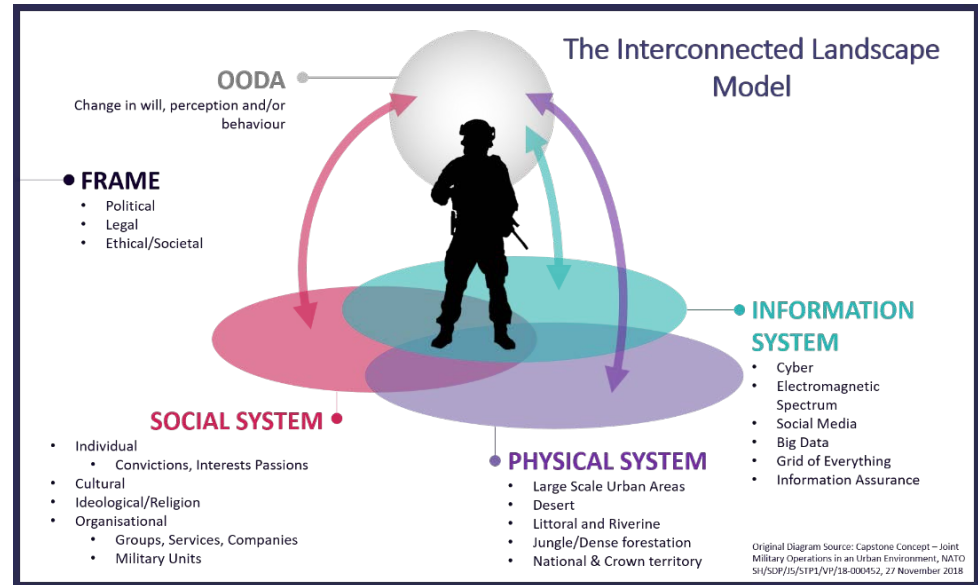
Senior Analyst – Defence Science & Technology Laboratory  
UK MOD

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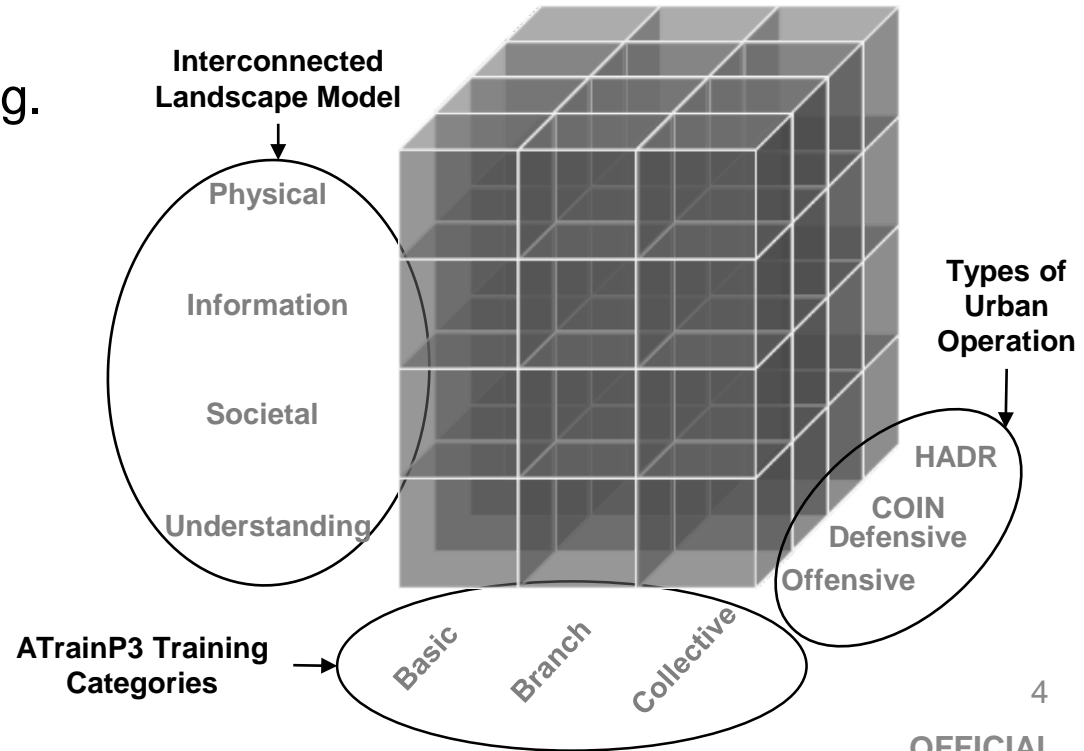
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- **Nature of Urban Environments**
  - **Urban Training Considerations**
  - **Current Urban M&S Solutions**
  - **Urban Model Abstraction**
  - **Urban M&S Spectrum**
  - **Next Steps**
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- Complex urban environments, can be understood as an adaptive system-of-systems, comprising:
  - Dense physical terrain with an underlying critical infrastructure
  - A human population with a complex social system
  - A multi-layered information system

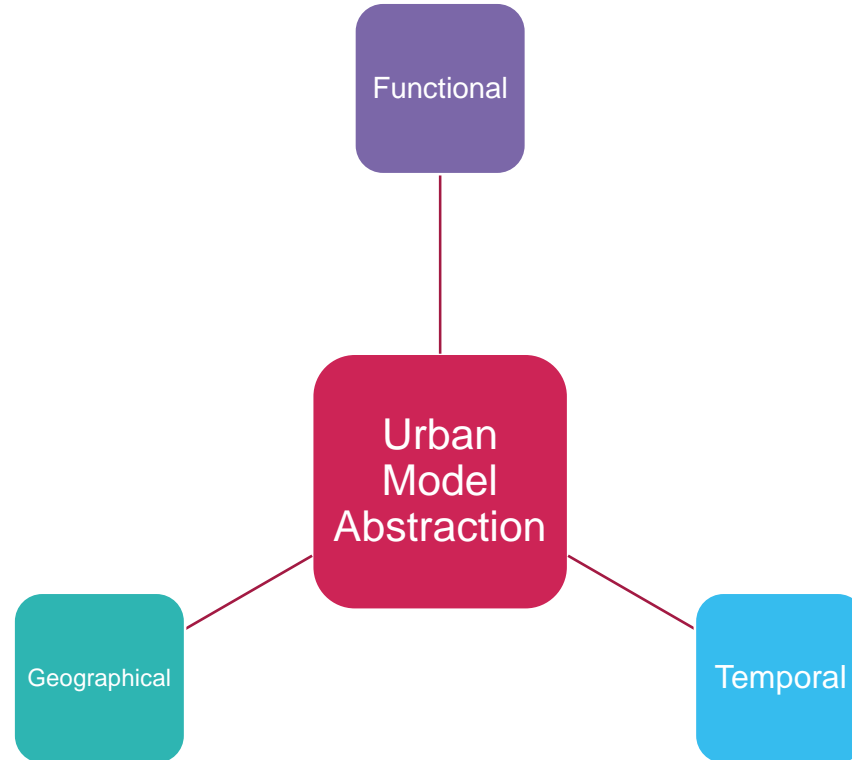


- Dstl commissioned study highlighted the M&S requirements for Urban Training. Factors included:
  - Interconnected Landscape Model
  - The urban training ATrainP-3 NATO STANAG
  - Types of Urban Operation
- Allowed the identification of factors that need to be represented in a live, virtual or constructive training environment



- Findings included:
  - Simulation can be employed to address many of the gaps identified in current training
  - Models designed for wargaming abstract critical factors needed to combine simulation with live urban training
  - There is still a gap in urban simulation required to support the development of cognitive skills at the team and collective training





# Functional Tiers: Inner Tactical Zone



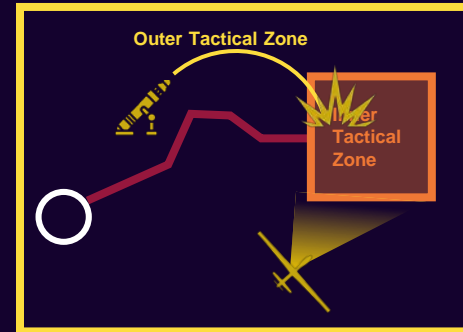
- Detailed simulation area – Focus on dismounted combat
- Optimised towards individual and small unit collective training, including cognitive development
- Operates in ‘real-time’ potentially in parallel with live activity
- Includes building interior walls, doors and partitions - May also include furnishings as appropriate
- Needs to be deformable, representing different construction materials and the effect of many weapon types
- Represent building services such as electrical power, water, gas and other potential hazards
- Resident population represented as individual agents



# Functional Tiers: Outer Tactical Zone

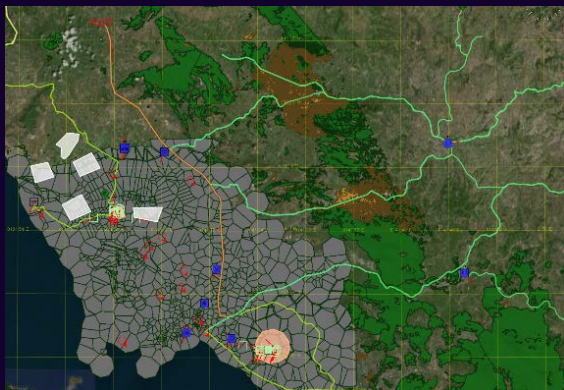


- Larger, lower fidelity region, also running in real time
- May be used to model ingress and egress routes or to provide context for higher formation activity, tactical ISR or indirect fires
- Buildings focused on exterior, with interior features limited to floors and partitions
- Disruption to Critical Infrastructure in the OTZ can be observed within the ITZ
- The population modelled as crowds or aggregated units to generate an appropriate 'pattern of life'
- Scaled to allow the placement of friendly and hostile constructive forces

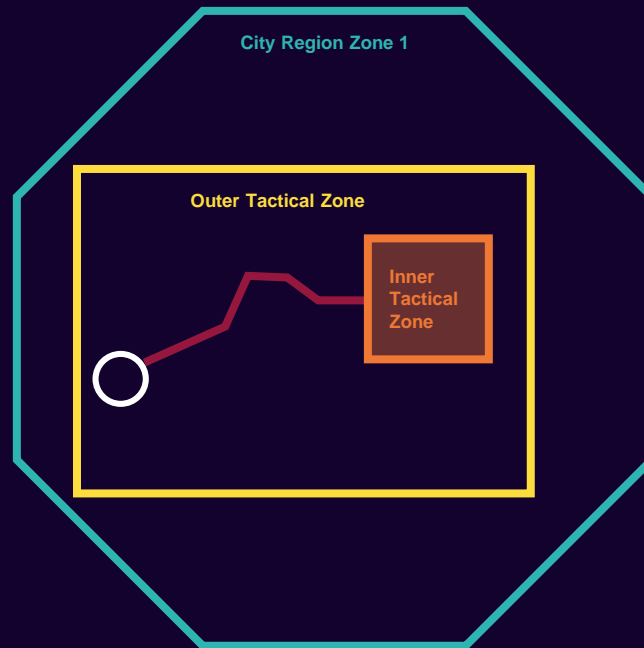




# Functional Tiers: City Region Zone

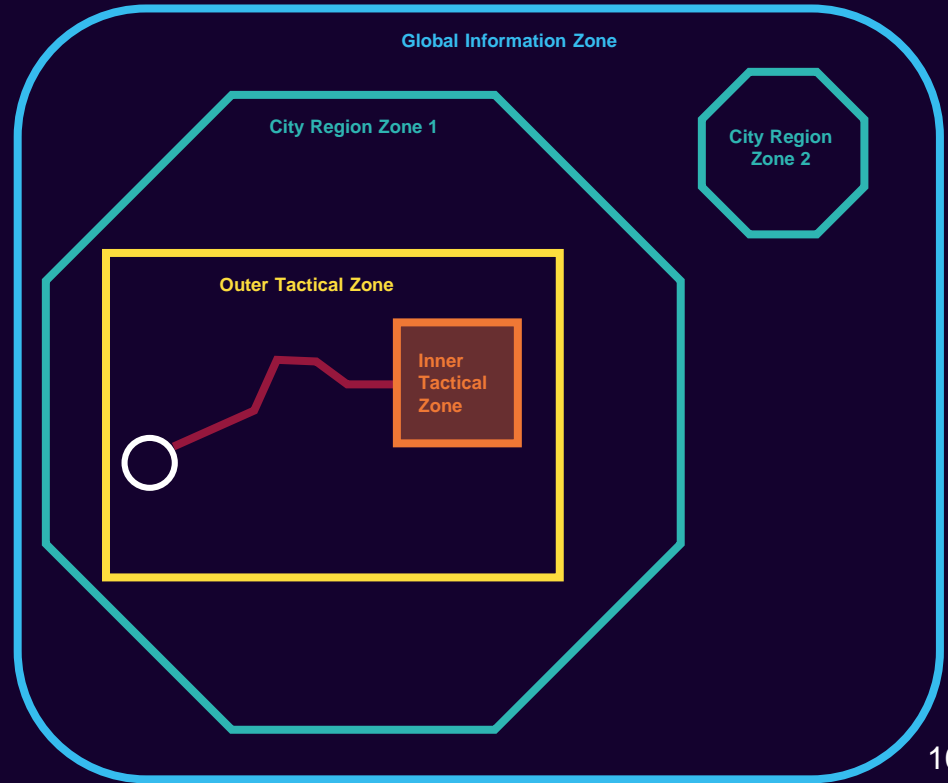


- Represents the wider political context - models all PMESII-PT effects
- Can evaluate the disruption to infrastructure networks, major population effects and hold the location of long-range indirect weapons systems
- Splits large urban areas like cities into multiple districts
- This zone can be described using a GIS engine or constructive simulation
- It may operate in discrete time steps with minutes or hours of activity processed at a time
- Population behaviours are modelled using highly aggregated models.





- Provides the outermost view for the whole operation
- Used to connect different city scale models together
- Predominantly an informational environment, although it could be used to store the geographical location of some long distant surveillance and fires systems
- Models influence activity (i.e. the sentiment and activity of a city's global diaspora)
- Suitable models may be time step or event driven based as they need to resolve long periods of activity



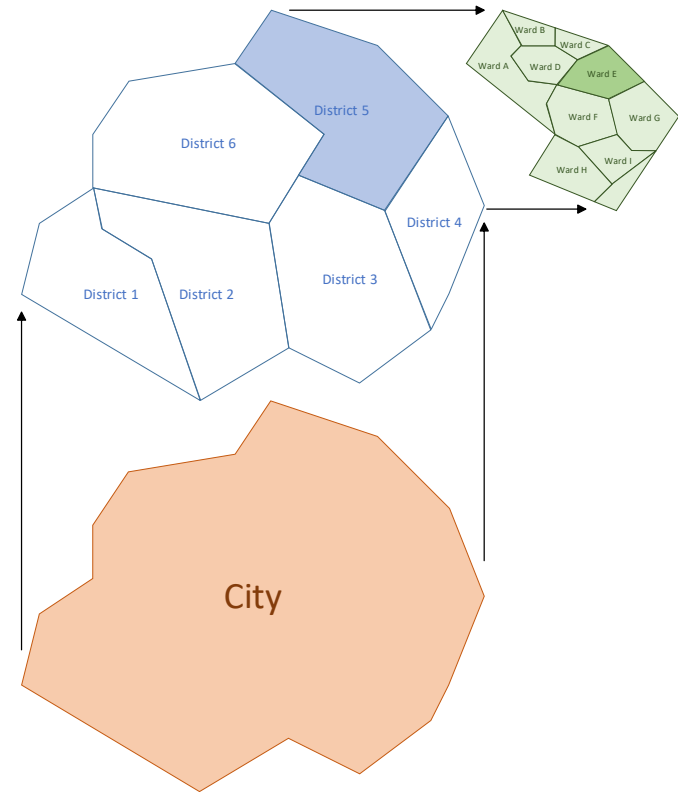
# What about Live?

- It's not been forgotten!
- Good for training for CQB skills and small scale FIBUA (villages & towns)
- Cannot represent the full complexity of urban warfare alone
- Limited representation of Critical Infrastructure, Social or Information environments
- Scale and Complexity offered by M&S is essential to train for the high cognitive demand



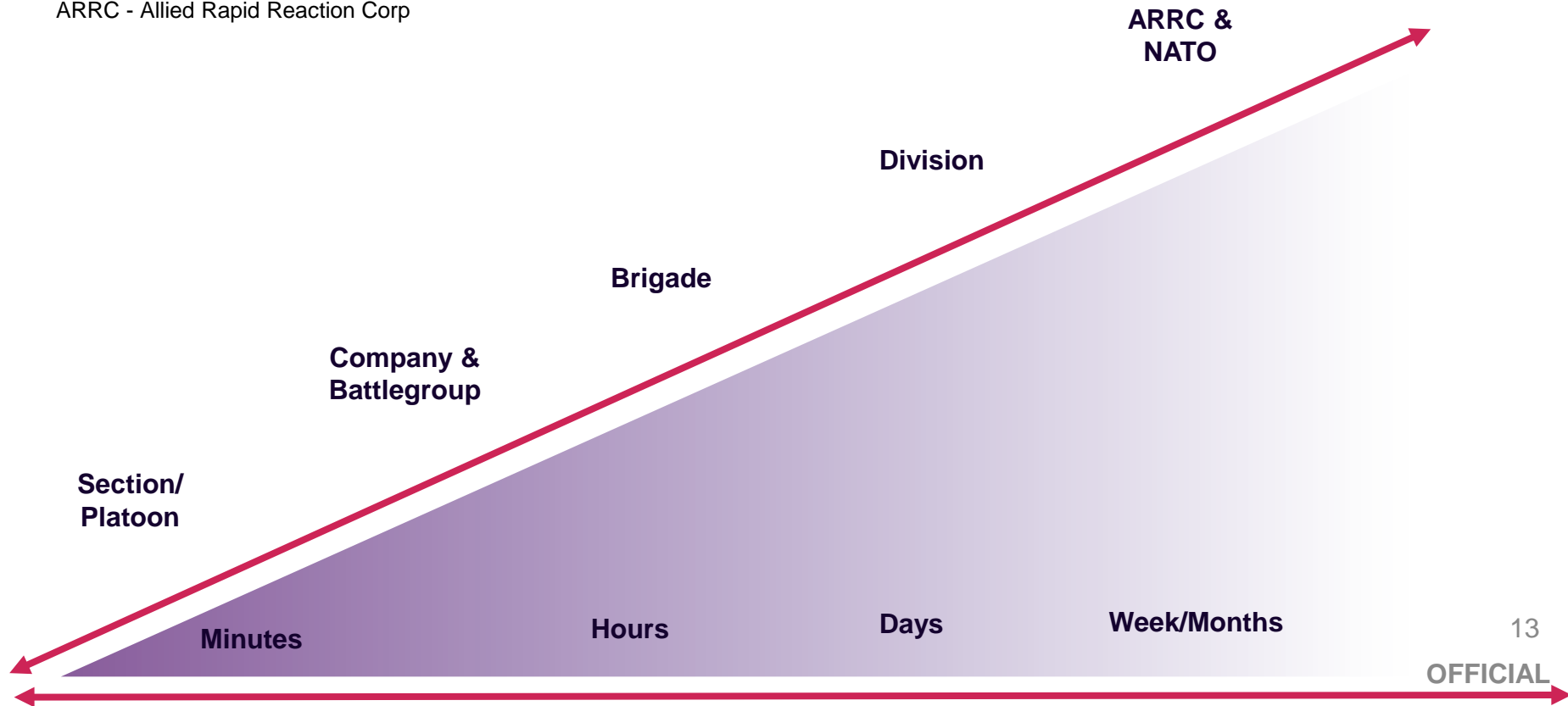
CQB – Close Quarters Battle  
FIBUA - Fighting in Built Up Areas

- A modern city is impractical to model in full detail
- To aid data acquisition and modelling, the city should be subdivided into smaller geographic blocks
- Detail should only be added where it is needed to support training requirements

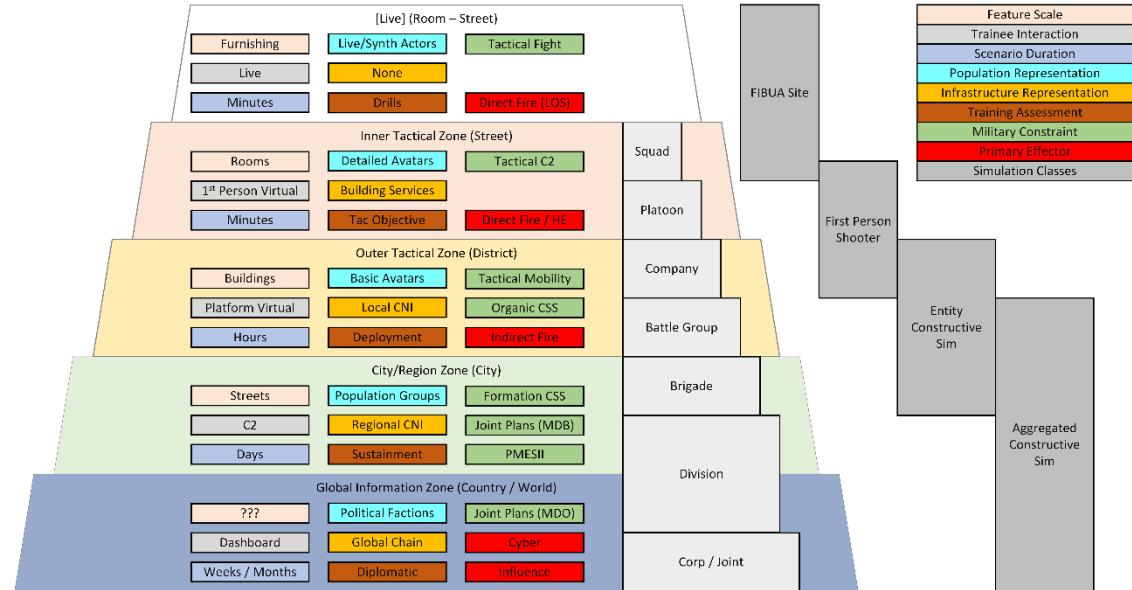


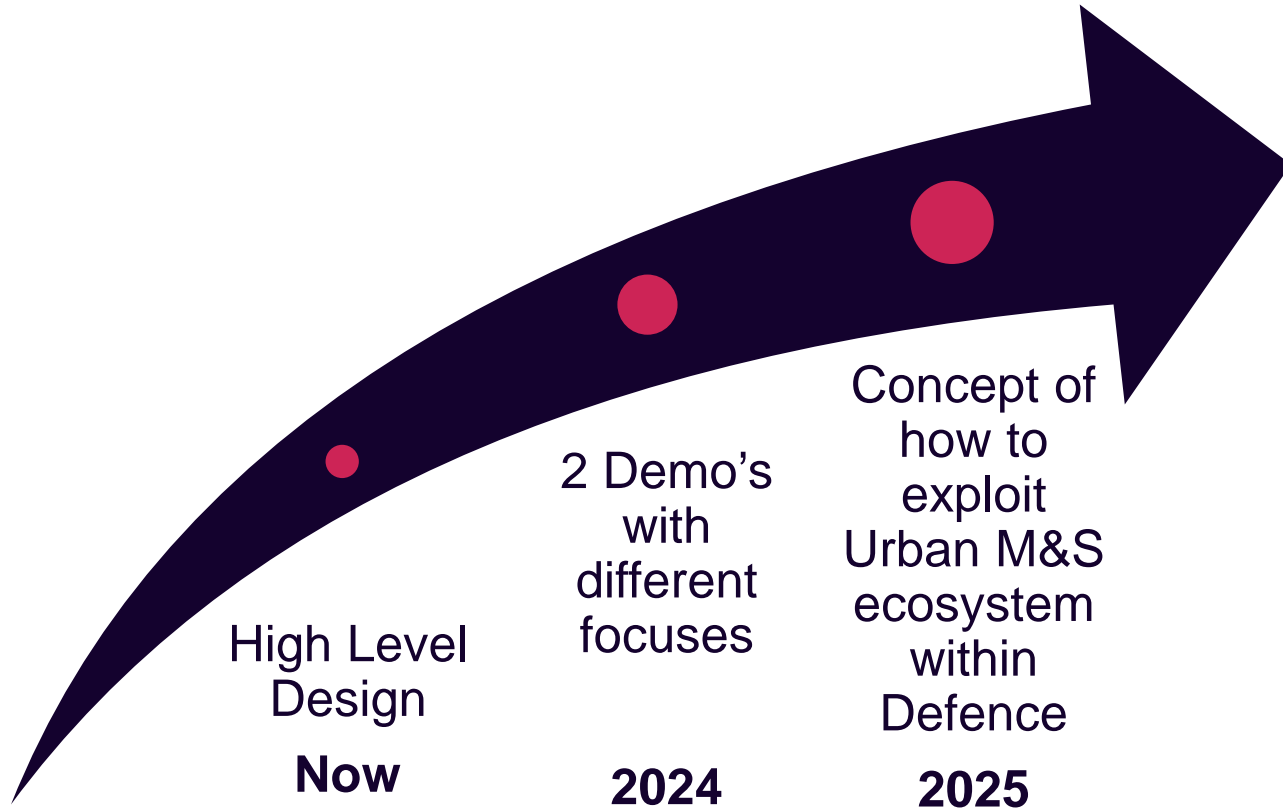
# Temporal Abstraction

ARRC - Allied Rapid Reaction Corp



- Combined model showing functional, geographical and temporal factors
- No single training use case requires ALL tiers
- HOWEVER.... Most training use case require at least two
- Concept describes an spectrum of urban models which can be composed to deliver a M&S eco-system





# Questions?

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Matt Smith

Senior Analyst – Developing Education Learning & Training Advances (DELTA)

[mcsmith2@dstl.gov.uk](mailto:mcsmith2@dstl.gov.uk)

