

# Adaptivity Led Networked Force Capability



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# Overview

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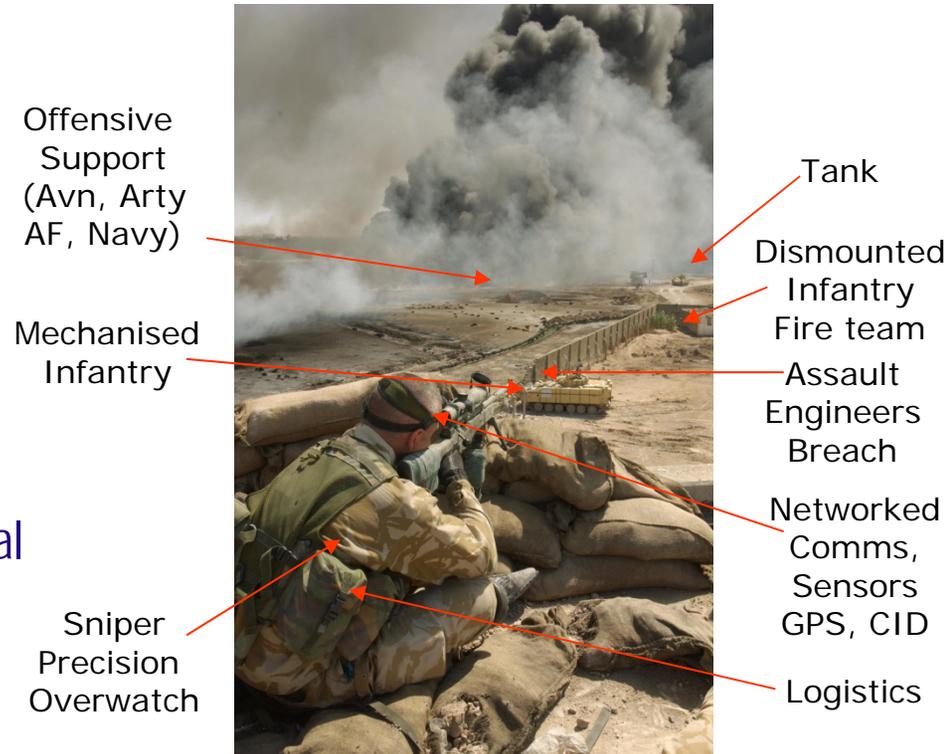
- The Challenge
- Networking Advantage
- Complex Adaptive Systems
  - Conceptual Framework for Adaptivity
- Force-Level Design & Capability Development
- Adaptivity Based Insights for Networked Force Capability
  - Operation Context
  - Force Development / Generation Contexts



# Complex Warfighting

- Land / Joint operations in contemporary conflict
  - Complex Evolving
  - Diverse Mixed
  - Diffuse Sensitive
  - Lethal Uncertain
- Close Combat is Critical
- Adaptive Teaming Approach
  - Joint, Interagency & Multi-national
  - To Lowest Practical Level
- ➔ Adaptive Campaigning
  - “Three Block War on steroids”
- Future Networked Force
  - Hardened & Networked Army

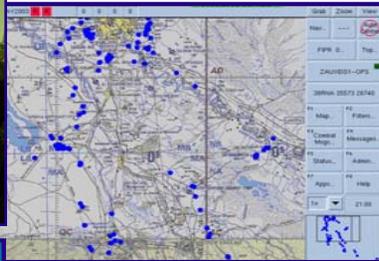
Joint, Task Organised Combined Arms Team (Basra)



20 Individuals (4 small teams) on ground networked with Responsive joint fires, sensors + comms



# Major Capability Acquisition Program (DCP ~ AU\$51B)





# Integration into a Networked Force

## ■ NCW SoS Context

- Large Number of Nodes
- Complex Environment
- Need to Regroup
- Varying Communications
- 24 Hour Operations
- Joint / Coalition / Interagency
- Adaptive Enemy

## ■ Delivered in Stovepipes

## ■ Range Of Networked Capabilities

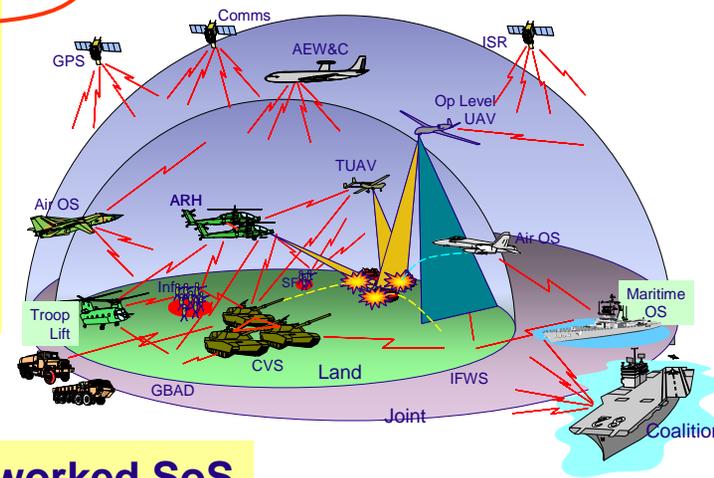
- Fully Networked
- Partially Networked
- Legacy Systems

- Sensors
- Actors
- Controllers
- Enablers

- Networked
- Partially Networked
- Legacy



- SoS Integration
- Concepts, Doc & TTPs
- Information Management
- Project Integration
- Interoperability
- Human Factors
- Cultural Evolution
- Training



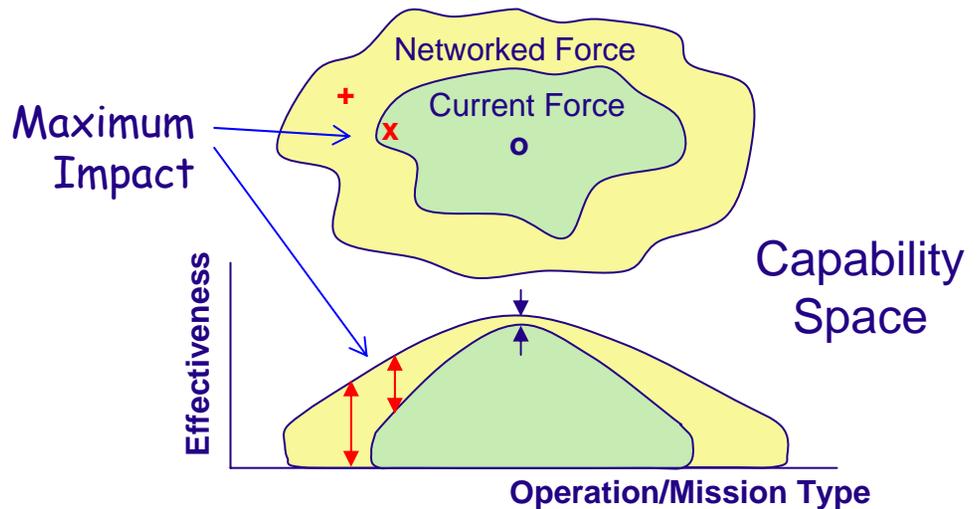
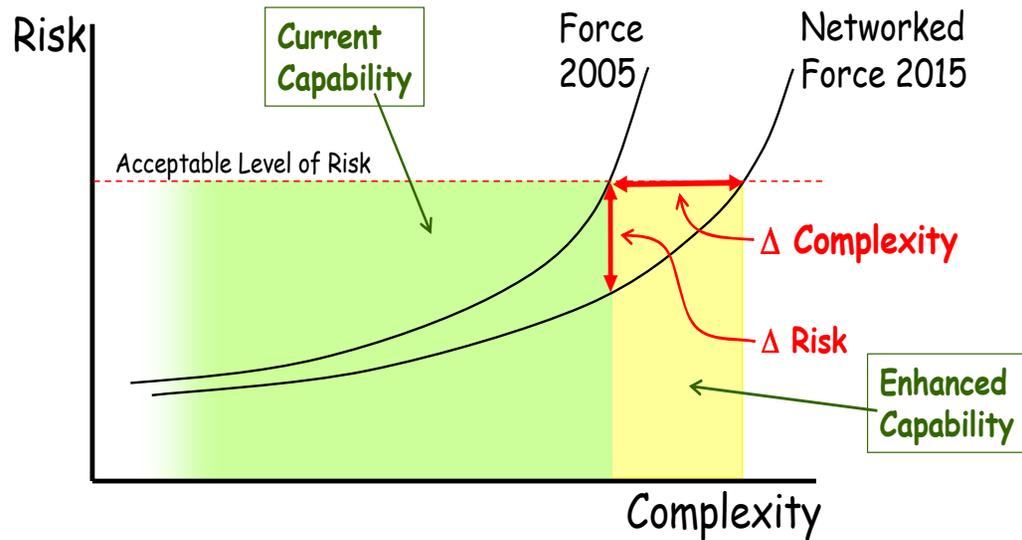
**Networked SoS**



# Networking Advantage Hypothesis

## Tactical NCW

- The ability of the Force to execute more complex operations at the same or lower risk through enhanced decision making enabled by shared SA, under-pinned by robust networks, professional mastery and mission command."
- More complex operations at same or lower risk
- Lower risks for current ops
- Increased success for challenging ops





# Implementing an Adaptive Networked Force

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- Design networked force for:
  - Enhanced Effects
  - Increased Survivability
  - Enhanced Adaptivity
  
- Focus on the Force as an adaptive SoS
  - Engendering adaptive characteristics
  - Evolving to meet the dynamic challenges of future Battlespace



# Complex Adaptive Systems

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- Complex systems which are adaptive – i.e. structure and behavior of the system changes over time in a way which tends to increase its 'success'.
- Being adaptive requires
  - concept of 'success or failure', or 'fitness', for system in its context
  - a source of variation in some internal details of the system
  - way of evaluating impact of a variation on fitness
  - a selection process, i.e. the system preferentially retains/discards variations which enhance/decrease its fitness



# Conceptual Framework for Adaptation

- Structured generic framework form adaptivity in complex systems

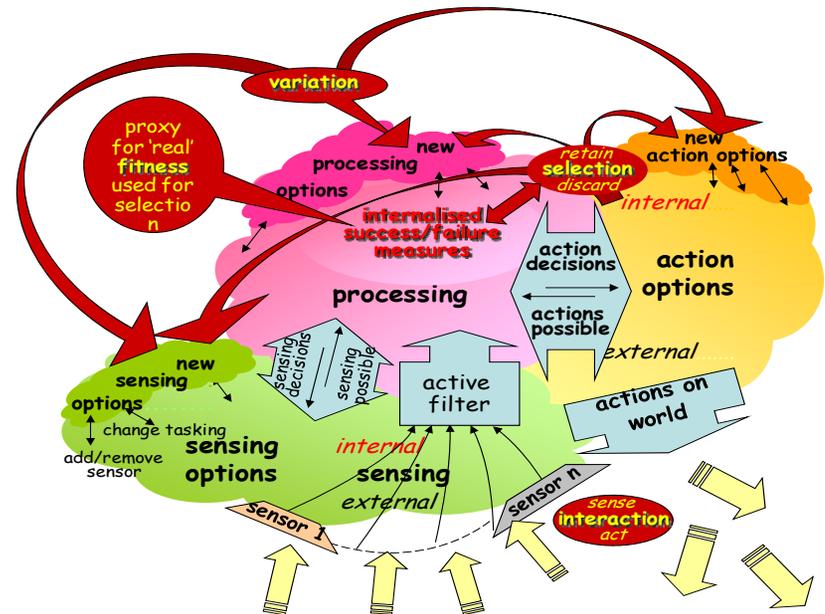
- Levels of Adaptivity

- Level 1: Action-in-the-World
- Level 2: Learning
- Level 3: Learning-to-learn
- Level 4: Defining Success
- Level 5: Co-Adaptation

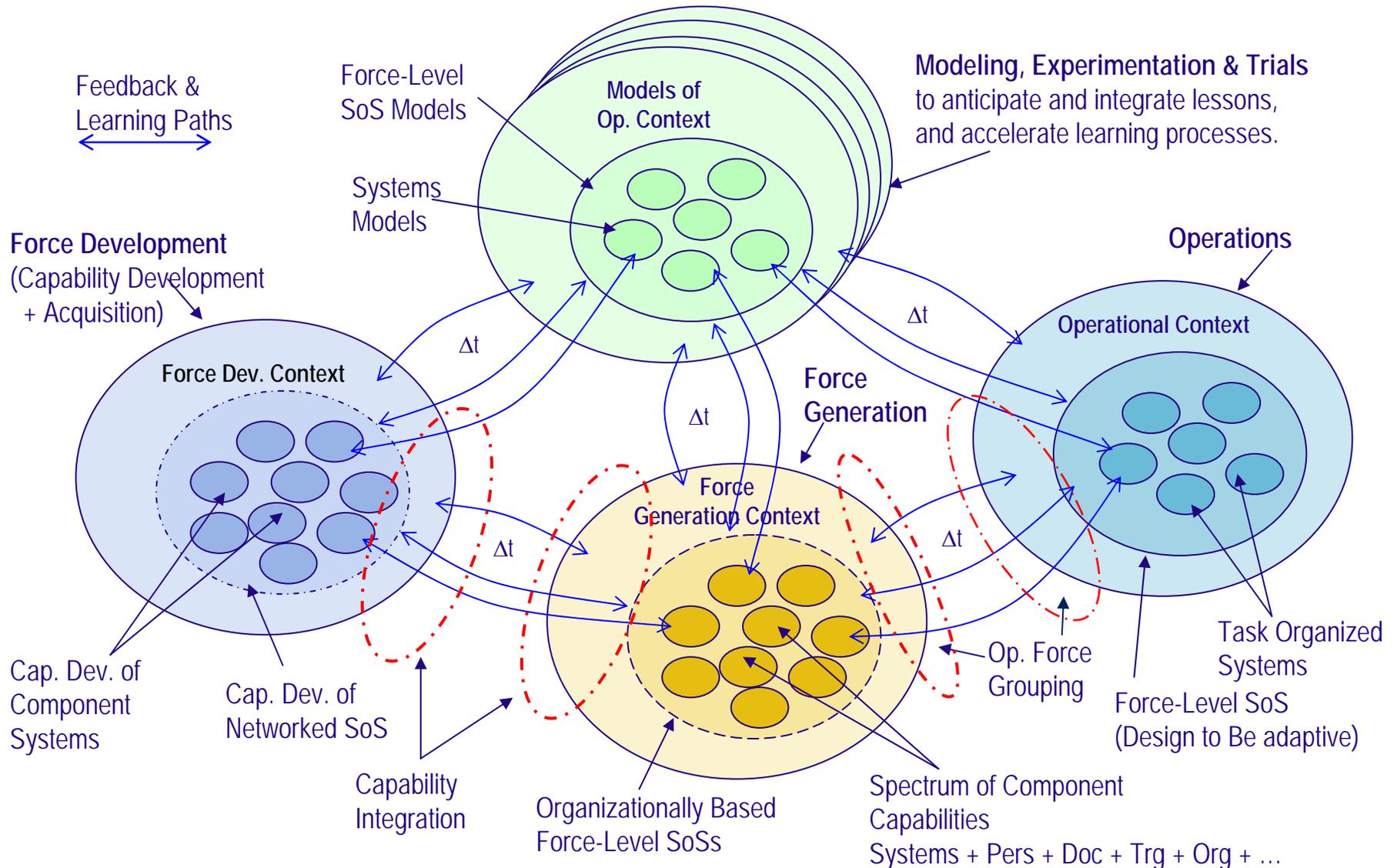
- Classes of Adaptivity

- Responsiveness: ability to respond to immediate threats & opportunities
- Resilience: ability to cope with shocks or harm to the system
- Agility: ability to implement changes in approach within a context
- Flexibility: ability to deal with new challenges and divergent contexts

- Scale – Ranging from individual to enterprise



# Force-level Design and Capability Development





# Current Force Adaptivity

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- Range of Adaptive Processes & Mechanisms in Current Forces, including:
  - Hierarchy of Command
    - Operating at difference scales and timeframes
  - Mission Command
    - Command by Intent
  - Training
    - Individual and Collective
    - Cultural education, including trust building
  - Lessons-Learnt Processes
    - Learning processes – usually with a large delay
  - Use of Modularisation, Specialisation, and Multi-roling
    - Both individuals and teams
- Need to build on these where possible



# Operational Context



## Operational Adaptivity - Responsiveness

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- High responsiveness is essential for military forces
  - More responsive fires, coordination of forces, ...
  - Most commonly addressed driver for NCW
- Expanding the palette of options available to commanders
- Increased tempo must be matched with co-adaptation of other elements to deliver enhanced force capability
- Faster is not always better
- Responsiveness in operations offers a variety of insights for NCW Design



# Operational Adaptivity – Responsiveness Insights

## ■ Level 1: Action

- Mission Command
- Effects based approaches
- Vertical alignment of effects
- Decision support tools
- Net. Battle Management Systems
- Blue SA
- Joint and coalition fires
- Net. Intelligence Systems & Tools
- Adaptive network management

## ■ Level 2: Learning

- Individual decision-maker learning
- Adaption of teams
- Rapid technology insertion
- Team and team-of-team perspectives
- Net. battle management processes

- Lessons learnt from operations
- Net. Information Management
- Reachback services
- Handling Information Uncertainty
- Appropriate modes of operation

## ■ Level 3: Learning-to-Learn

- Training Effectiveness
- How lessons are learnt
- Effectiveness of technology insertion
- Learning across operational contexts

## ■ Level 4: Defining Success

- Examine assumptions & metrics to ensure you don't "win the battle but lose the war"

## ■ Level 5: Co-Adaptation

- Enable co-adaptation at lower levels of command



## Operational Adaptivity - Resilience

NCW can both **increase** or **decrease** force resilience

- Adaptive / ad hoc networks
- Adaptive IM and IM Policies for
  - Information Prioritisation
  - Variations in demand / comms capacity
- Management of Diversity / Uncertainty
- Distributed forces and C2
  - Reduced vulnerability
  - Reduced physical footprint
- Design for graceful degradation
- Ability to function autonomously
  - Mission command
  - Data pre-positioning
  - Replication of Data

- Increased centralisation
- Disaggregated Forces
- Fragile networks
  - Catastrophic Network Failure
- Lack of interoperability
  - Increased vulnerability
- Poor Information Management
  - Information overload
  - Inappropriate information
  - Reduced Trust
- Assumption of info superiority
- Increased EM footprint



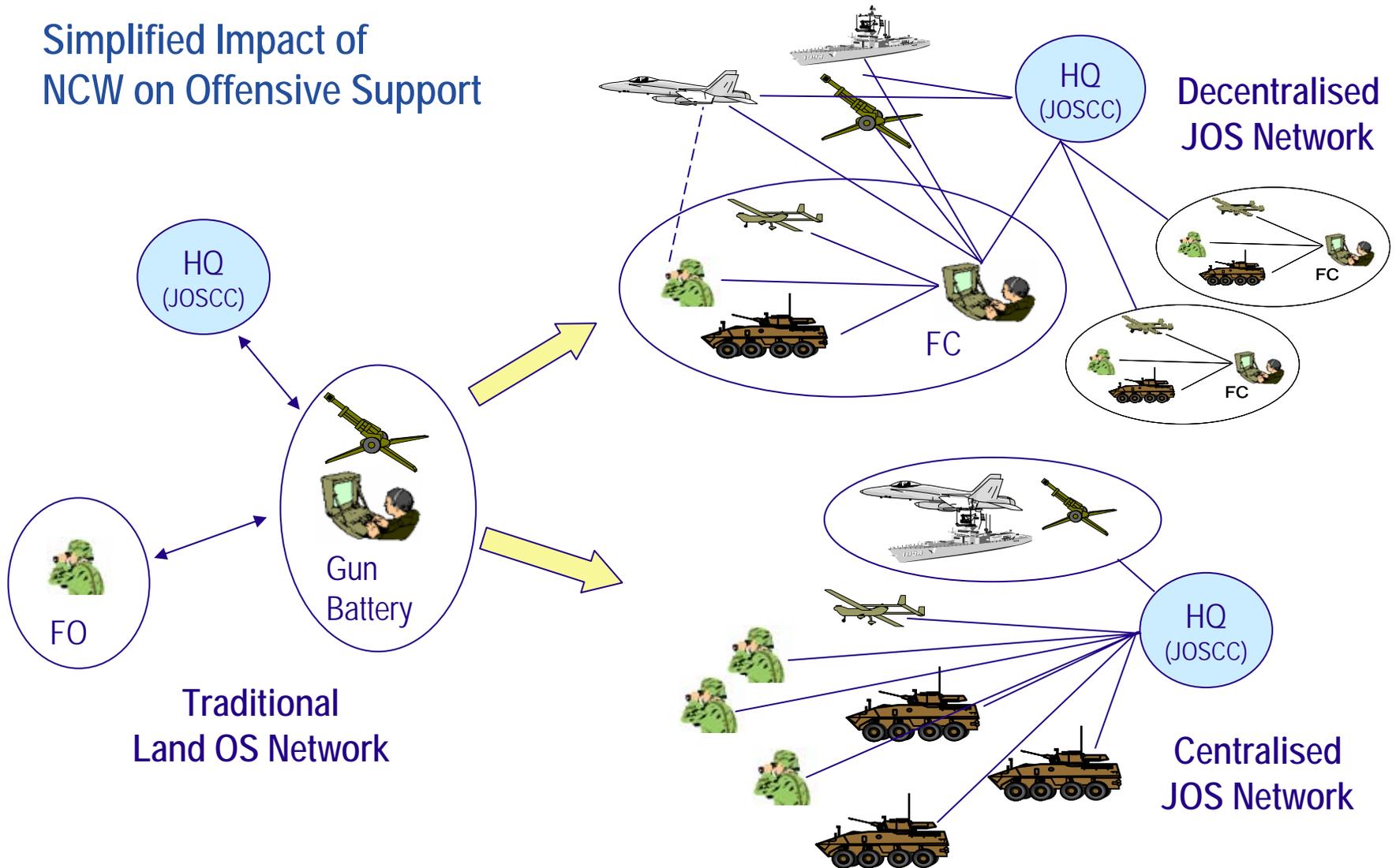
## Operational Adaptivity - Agility

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- Remaining effective no matter what happens
- Enabling decentralized and multi-layered force agility
  - Extension of Mission Command
- Key insights for networked force design:
  - Knowing when change is needed
    - Monitoring Indicators
    - Dynamic Tasking and Assessment
  - Coordination of changes
  - Appropriate C2
    - Ability to shift modes
    - Ability to apply concurrent C2 modes
  - Forming and re-forming teams
  - Use of Reachback to support force agility
    - Experimentation and options development

# Example: Networked Joint Offensive Support

Simplified Impact of  
NCW on Offensive Support





## Operational Adaptivity - Flexibility

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- **Flexibility requires:**
  - Develop appropriate measures of success & monitor
  - Develop strategies & capabilities across spectrum of operations
  - Rapidly bring teams up to operational level
- **Preliminary Insights for Networking**
  - Facilitate innovation and improvisation to deal with the unforeseen
  - Ability to deal across cultural boundaries
    - Within a Joint / Coalition / Multinational / Inter-agency force
    - Adapting the balance of explicit to implicit information
  - Reorganization of a force to undertake different roles
    - Highly dependant on the effectiveness of the force generation stage



# Force Development & Force Generation Contexts

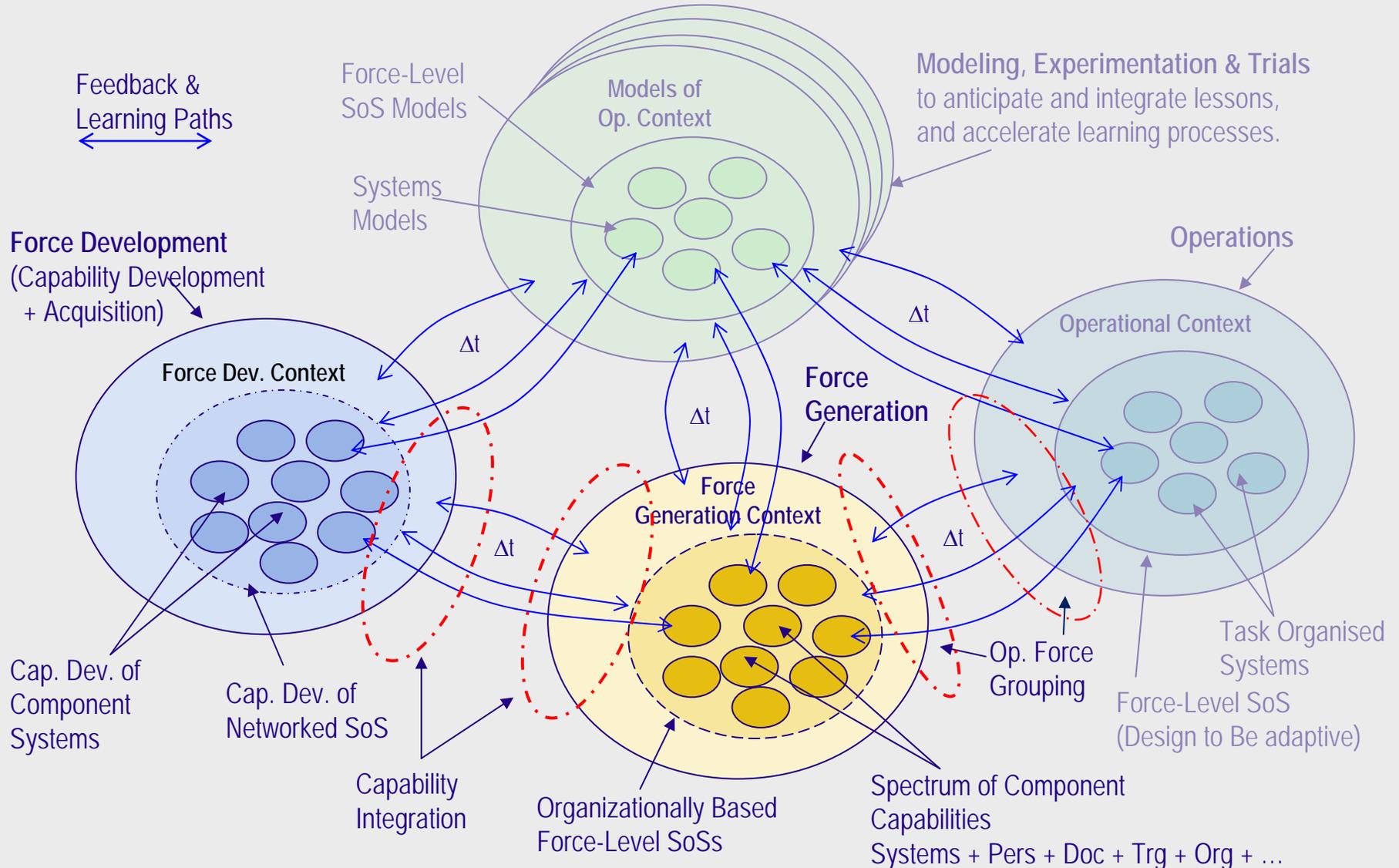


# Force Development and Force Generation Insights

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- **Generation of Adaptive capabilities**
  - Implement foundations for the NCW operational insights
  - Adaptive by Design
  - Focus on the SoS / Force level
- **Implementation of adaptive processes**
  - Force Development
  - Force Generation
- **Complex Systems Engineering Approach**
- **Following provide some general insights**
  - More in depth discussion is beyond the scope / space of this paper

# Force Development and Generation





## Force Dev. & Gen - Responsiveness

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- Responsiveness of the Force Development and Generation Processes
- Level 1: Action
  - Utilize lessons learnt to ID changes requirements, Doctrine, TTPs, Training, ...
  - Monitor appropriate indicators / proxies & act promptly
- Level 2: Learning
  - Be more open to lessons and resist seeing changes as “scope creep”
  - Improve ability to detect and respond to threats and opportunities
- Level 3: Learning-to-learn
  - Monitor success and identify ways to learn more effectively
  - Utilize Modeling and Simulation to explore future options
- Level 4: Defining Success
  - Identify appropriate indicators and proxies
  - Broaden success metrics to encompass team and networking measures
- Level 5: Co-Adaptation
  - Address both individual projects and force level design



## Force Dev. & Gen - Resilience

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- Delivering the most important capability outcomes despite changes
  - Force development & generation processes
  - Capabilities produced
- Design capabilities such that
  - Core functions are clearly identified and can be maintained
    - Exploiting redundancy and rerouting / rerolling of system elements
    - Design repairable, self-healing or easily replaceable systems
  - Design for graceful degradation / integration
  - Force-level or SoS co-adaptive solutions
    - Resilient networks
    - Redundancy across wider SoS
    - Reconfiguration across the wider SoS
  - Balance costs, risks and benefits of resilience versus effectiveness
  - Invest in interoperability
    - Systems level
    - Force-level



## Force Dev. & Gen - Agility

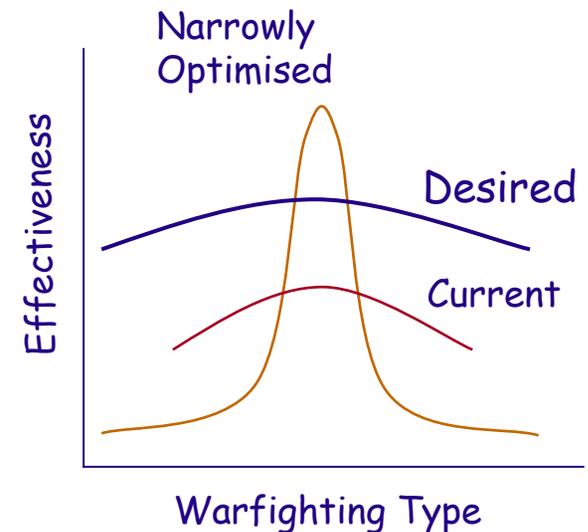
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- Agility in the force development and generation processes
- Re-evaluate assumptions about force capabilities and networking in light of lessons learnt
  - Operational & Experimental
- Coping with long timescales and separate 'stovepiped' systems
  - Holistic integrated capability development
    - e.g. FCS, FRES (UK), ...
  - Utilize modeling, experimentation and trials
    - Accelerating learning timeframes and addressing a wider range of options
- Education to achieve cultural changes
  - Force development – moving to Joint and SoS approaches
    - Interoperability across technical, semantic, systems and enterprise levels
    - including legacy systems
  - Force generation – realizing the potential networked capability
  - Training to operate across multiple modes as required



## Force Dev. & Gen - Flexibility

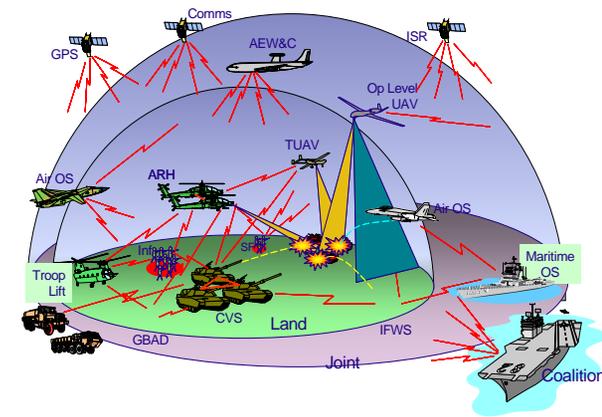
- Design the networked force to be effective across as wide a range as possible.
- Danger of generating a narrow optimisation
  - Networks, TTPs, C2, IM locally optimised
  - Highly efficient
  - Ineffective outside area of optimisation
- Design Force-level Capabilities
  - Designed for a Spectrum of Operations
  - Task organized
  - Training across a Spectrum of Operations
- Force-Level Design trade-offs
  - Time, Equipment, Personnel, ...
- Need to address requirements for responsiveness, resilience & agility across a wide range of contexts.





# Conclusion

- Force networking delivers an integrated force capable of:
  - Coping with greater complexity
  - More effectively undertaking difficult tasks
  - Undertaking current complexity at lower risk
- Networked Force Adaptivity
  - Current force has a variety of mechanisms
  - Use conceptual framework for adaptation to ID
    - Areas to increase force adaptivity
    - Risks & vulnerabilities to manage
    - Options for networked force design
  - Consideration of both operations and force development/generation
- Force-level approach to Network force capability
  - Focus on adaptivity provides a balanced whole of force perspective





# QUESTIONS