

# Co-operative Weapons

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# Scope of Presentation

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- Background
- Cooperative Weapons principles
- Example Applications
- Analysis of key benefits
- Technologies
  - Specific to Cooperative Weapons
  - Generally applicable to class of weapon
- Summary

## Concept Team Role

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- Anticipate the market
  - Undertake critical technical work to provide an agile response to opportunities
  - Provide an initial analysis of the opportunity and potential solutions
- To develop outline concepts to the level of an initial briefing
  - May identify more than one solution to an requirement
  - Each concept will be linked to its key technologies
- Small team (3-4 people)
- Investigations undertaken as a series of topics
  - Typically 6-12 weeks duration
  - Each with a deliverable report (“white paper”, containing concept outline)

# Introduction

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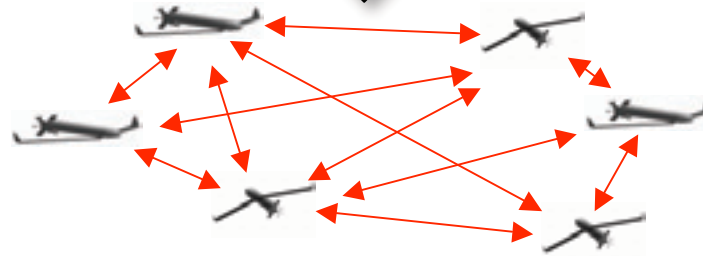
## The challenge



**Wide operational context  
Rapid threat evolution?  
Budget pressures**



## Part of the solution?



**Cooperative Weapons  
Achieving effect collectively  
Optimised through communication  
Different design challenges?**

# Existing forms of Cooperation

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## TEWA

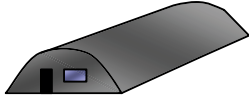


- Threat Evaluation and Weapon Assignment
- Engagement of multiple targets using multiple weapons
  
- Large body of experience
  - Generally a sequential, scheduling problem
  
- Decisions usually made centrally by the weapon control system
  - Also distributed architectures

## NEC

- Network Enabled Capability
- Based on information sharing
  - Breaks the platform centric paradigm
  
- Agile mission groups
  - Ad hoc collection of entities that are task organised
  - And share data between them
  
- Control exercised by a control node or platform

Cooperative weapons build on and extend these principles

# The cost challenge of the threat spectrum

- Bunkers 
- Buildings
- Engineering Vehicles
- Main Battle Tanks 
- Infantry Fighting Vehicles
- APCs & SPGs
- Mortars/ Rocket launchers
- People behind cover
- 4x4 soft skinned vehicles
- People in open 

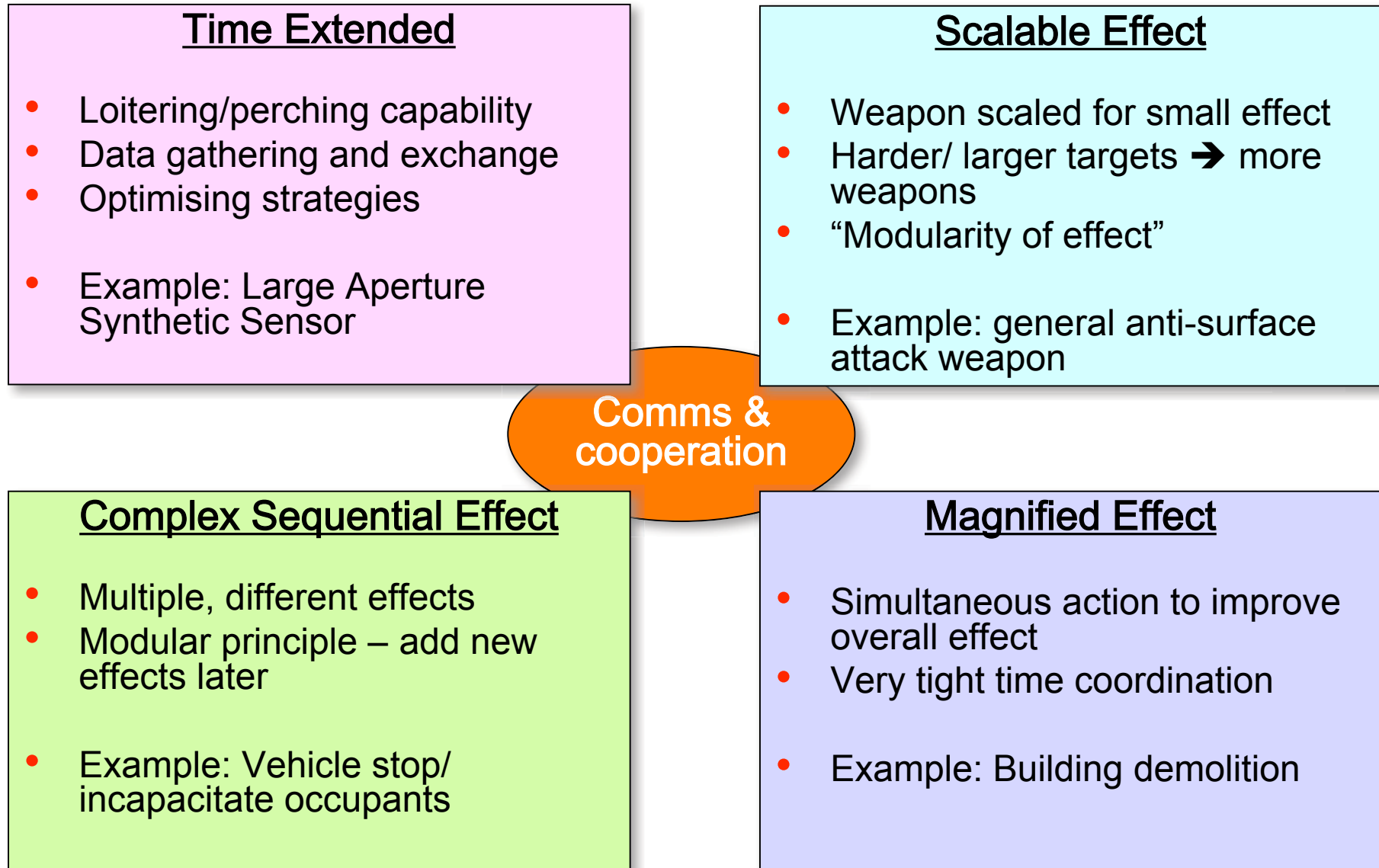
Approach 1

- Specialised weapons for many different targets
- High cost of multiple developments
- Separate stockpiles
- Logistical complexity

Approach 2

- Common missile for many roles
  - Reduced development
- Design driven by hardest target
  - High mass and UPC
  - Restricted platforms

# Classes of cooperative weapons



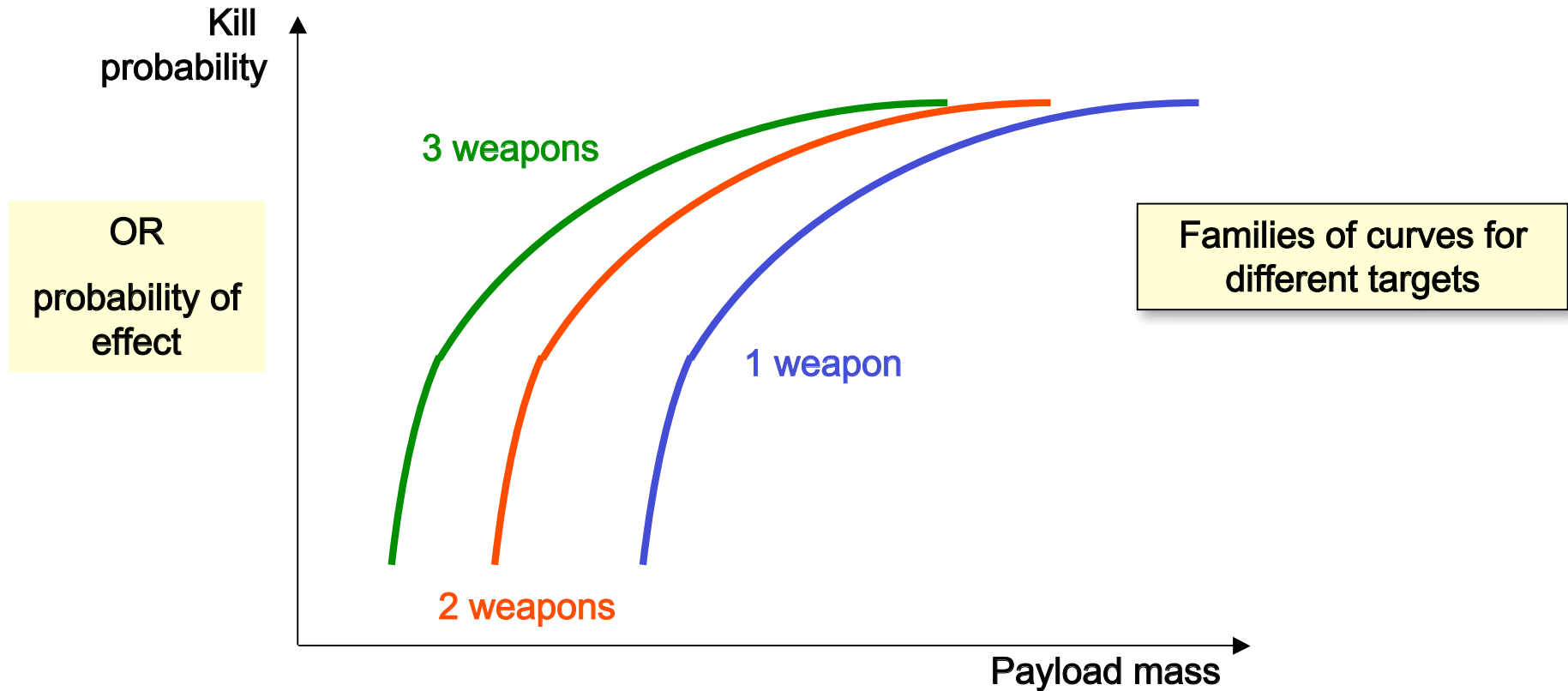
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## Example 1 – group of insurgents/ militia / infantry

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- Objective: destroy/ deter/ suppress
- All types of operation
- Urban, Suburban or Rural Context
  - Varying levels of collateral risk
- Initial position from ISTAR asset or troops in contact
- Group size variable
- Solution – Scalable effect weapon (small)
  - Payload of weapon sized for individual and immediate vicinity
- Many on Many problem
  - Number of weapons dependent on the size of group
  - Don't need to kill all the group to achieve effect
  - Algorithms to spread effect as the group may move / flee
- Time extended effect – send in weapons progressively over time
  - Short time loiter capability
- Complex effect – add bangs/ flashes

# Design trade-offs for scalable effect



What level of effect is militarily useful?  
What is minimum size for wide commonality?



Magnified effect as growth for extremes?

## Example 2: Fleeing Leadership target in Vehicle

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- Objective: Kill leader
- Present in Focused Intervention, Peace Enforcement, Current Ops
- Urban Context
  - high rise commercial buildings to domestic dwellings
  - Other vehicles
  - High Collateral risk
- Continuous track from ISTAR assets
  - Time sensitive – a few minutes
- Solution – Complex Sequential Effect
  - First weapon designed to stop the vehicle without collateral damage
  - Second (and 3rd / 4<sup>th</sup>) weapon to deal with occupants
    - Either inside the vehicle or outside the vehicle
  - Could be the anti-personnel weapon from example 1
  - Or a non lethal weapon or a marker

## Benefits

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- Use smaller munitions in an intelligent attack to achieve the same result with reduced collateral effect
  - Reduced UPC
- Enable scalable effect for diverse threats and scenarios with a single weapon, or small modular group of weapons
- Offer a logistics saving with a reduced set of smaller munitions but retaining operational capability
  - Reduce the number of different weapons per platform/ unit
- Provide a flexible, modular solution with many potential applications.
  - Reduce development and stockpiles
- Growth potential through adding variants to the family for different effects
  - Or use the set in new ways to adapt to different operational drivers
- Reduce the operator load using delegated autonomy of action
  - Critical for real time management of more complex effects

# General technology challenges

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- Complex mission planning
- Potentially complex targeting requirements
- Flexible architecture
- Dynamic mission management
- Self monitoring system of systems
- Recognise system degradations or failures
- Communications - bandwidth and data transfer concerns are especially pertinent
- Many-on -Many engagement and data fusion
- Guidance

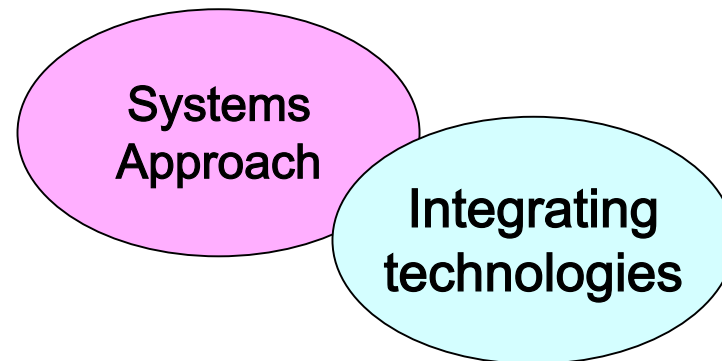
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## Relevant Research

- **SEAS DTC**
  - Mission planning and decision making
  - Sensor exploitation
  - Communication and control
  - Algorithms and architectures
- **ITP**
  - Vehicle identification
  - Cooperative guidance
  - Tuneable effects warheads
  - Short lethal area warhead, Anti FIAC proximity fuze (moving vehicles)
  - Missile datalinks



# Specific Technologies required

**Time Extended**

- Alternative sensor types
- Short term loitering capability

**Scalable Effect**

- Hit in same place
  - Marker seeking?
  - Centimetric accuracy
- Warhead design
- Minimise size and cost

Small agile missiles

**Complex Sequential Effect**

- Develop the range of effects
- Mission planning and coordination
- Time on target sequencing

**Magnified Effect**

- Very tight time coordination
- Research into combined / sequenced detonations

## DLOD Issues to be overcome

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- **CONEMP:** Planning and controlling many-on-many individual effects
  - Acceptable degree and mechanisms for delegation and supervision of weapons cloud
  - Also impacts PERSONNEL and TRAINING
- **LOGISTICS:** Packaging and supplying many different types of effectors
  - Battleboxes or a "jack of all trades"
- **EQUIPMENT:** Countermeasures – local weapon-weapon comms
  - Robustness of coordination and control mechanisms
- **INFORMATION:** How much external targeting information is useful?
  - How much information should be sent back?

# Summary

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- New type of concept based on local comms in a group of weapons
  - Goes beyond the principles of coordination through NEC
- Multiple classes of cooperative weapons
  - Time extended/ sensing to scalable and magnified effect
- Key benefits
  - Complex, adaptive and scalable effects, including modularity in effect/ time
  - Increased performance from lower cost weapons
- Many technologies in common with small agile missiles but also some with greater emphasis or unique requirements
  - Challenge is taking a many on many approach
  - Integrating individual technologies into practical and affordable systems
- Biggest challenge is intellectual
  - Understanding the potential
  - Working with the customer to decide what is of value