Enabling Complex Weapons Testing within Smaller Ranges

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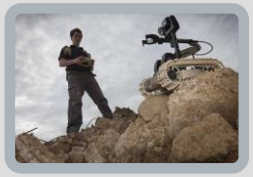
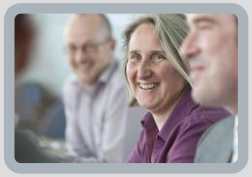
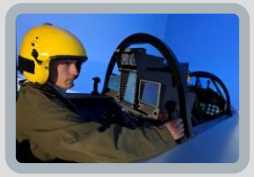


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QinetiQ's role in Test and Evaluation

Provision of specialist advice and services to a wide range of customers on testing, evaluation and acceptance of military systems

- World class knowledge underpinned by our deep research heritage

Long Term Partnering Agreement

- Delivers test & evaluation and training support services at 17 core MOD owned or leased UK sites
- Covers Land, Sea, Air, Weapons and Training Support Domains
- Provides a source of advice and assistance across MoD for Integrated Test Evaluation and Acceptance (ITEA)

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Overview

UK Land Attack Complex Weapons undergo a significant proportion of their firing trials for development, acceptance and through-life support overseas

Starting premise is that

- There are programme benefits from undertaking UK weapon firing trials in the UK
- Firing trials will continue to be required

This paper focusses on testing future land attack complex weapons and will discuss

- The benefits of doing firing trials at home
- The goals of firings from the perspective of Developer, Acceptance authority and User
- The challenges faced on UK ranges
- Options to address these challenges
- Key enablers

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Why do more at home?

Benefits

- More efficient trials programme - not linked to pre-defined overseas deployments
- Development and training are more easily integrated within a coherent programme
- Flexibility to resolve unexpected events both for customer and developer
- All the necessary people can be made available at short notice/no time zone issues
- Easier planning and support to the enabling of complex trials
- Leverage on Investment in Test Ranges
- Better value for money

So why are firings not currently done in the UK?

- Using current deterministic methods the Weapon Hazard Area is typically too large for the available land mass

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Why do we do firings?

During Development

- Gain confidence in the maturing design
- Verify system and sub-system models

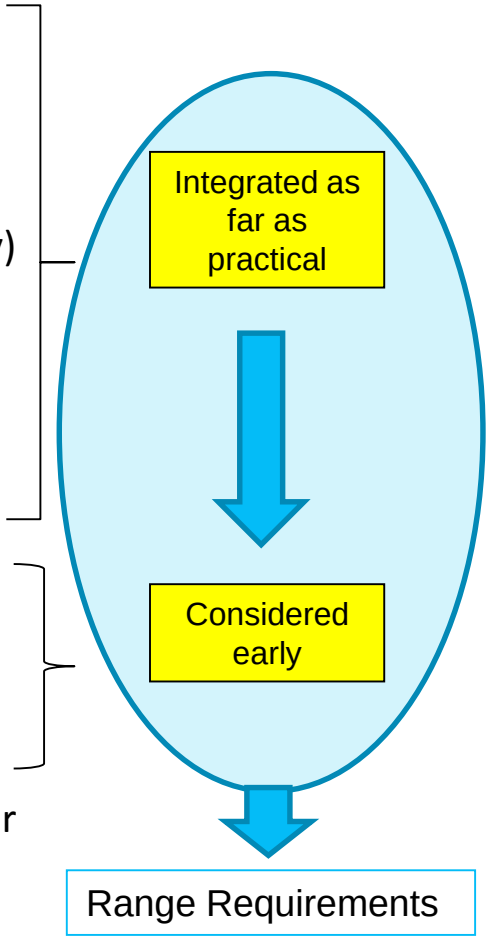
To support Capability Acceptance

- Demonstrate the equipment meets its key requirements (e.g. lethality)
- Full end-end functional test (including loading)
- Confirm the equipment integrates with other systems to achieve required systems of systems performance
- Development of Training, Tactics, Concepts and Doctrine

In-service

- Operational training/Confidence
- Continuing development of tactics
- Check end-end functionality following system changes

Firing trials are relatively expensive but reveal emergent behaviours under conditions that can not be replicated (easily) on the ground



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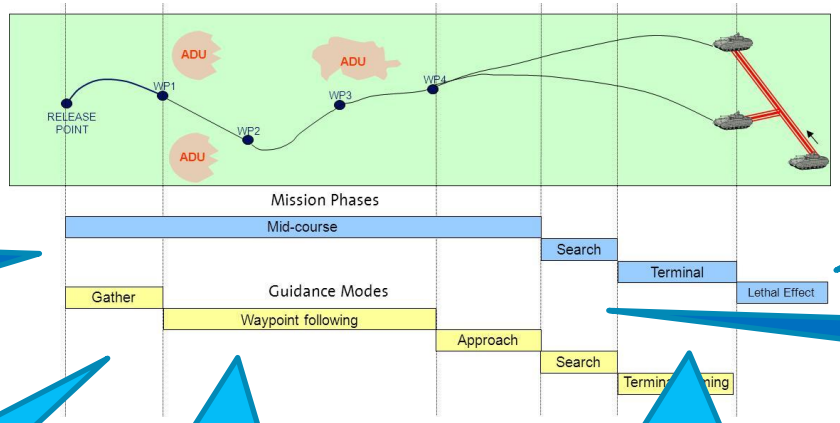
What is the real Requirement?

Requires weapon drop

No weapon drop



Warhead performance

Demonstrate mission planner

Target acquisition across range of vignettes

Safe launch and jettison

Weapon navigation and control

Closed loop guidance

Do we need to address all of these in a single firing?

Use of sea ranges

Small land range with simple vignettes

Large land range with complex vignettes

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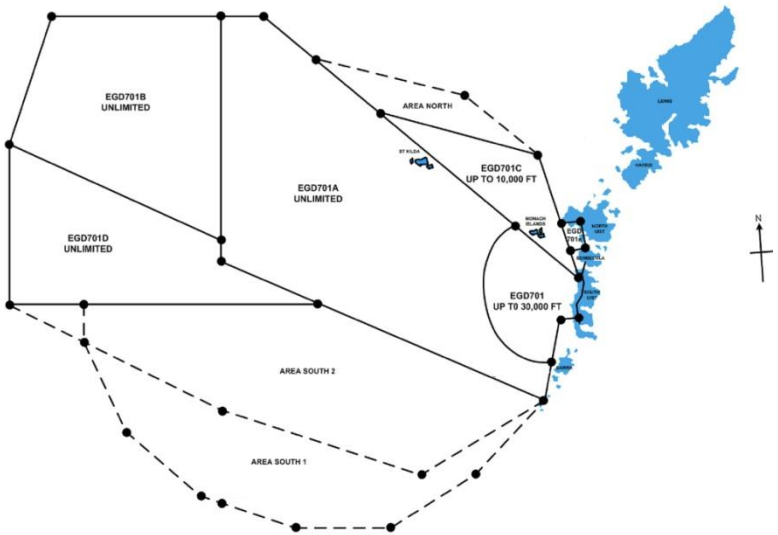
UK Based Firings - Challenges

UK has some of the largest and best instrumented weapon ranges in Europe

- Principally Over-Sea Ranges
- Land space is typically small
- Traditional Maximum Energy Boundary (Deterministic) approach to Weapon Hazard Area would rule out the use of these ranges for long range land attack weapons
- Need a more thoughtful approach to the development of a viable safety case based on a progressively reduced Weapon Hazard Area



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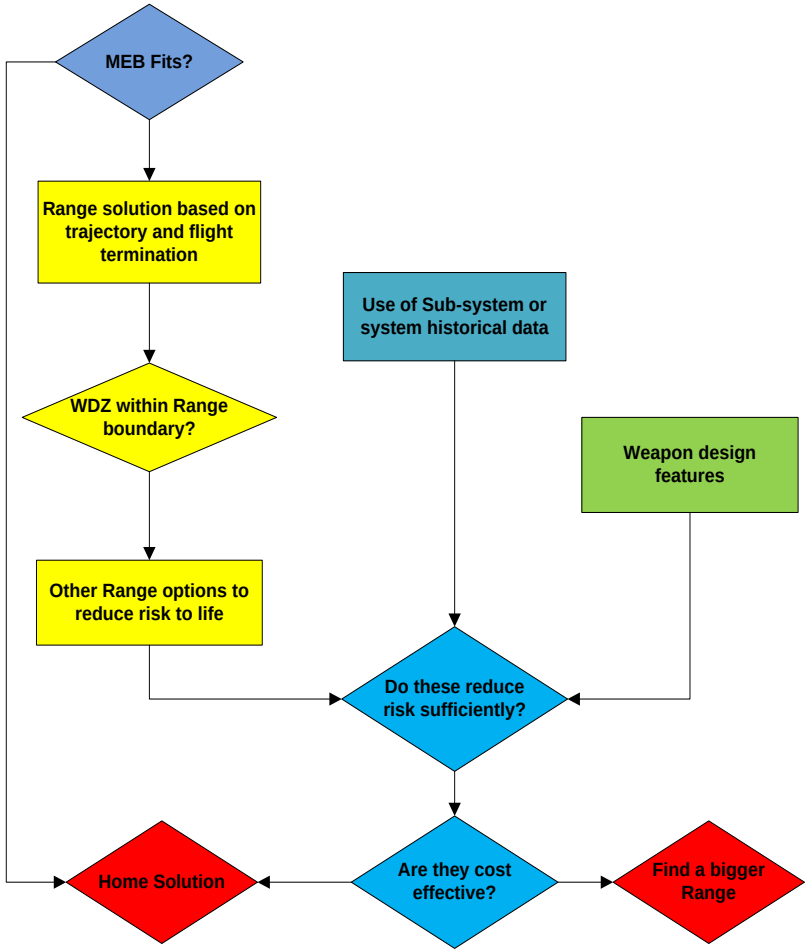
Reducing the Weapon Hazard Area

Opportunities

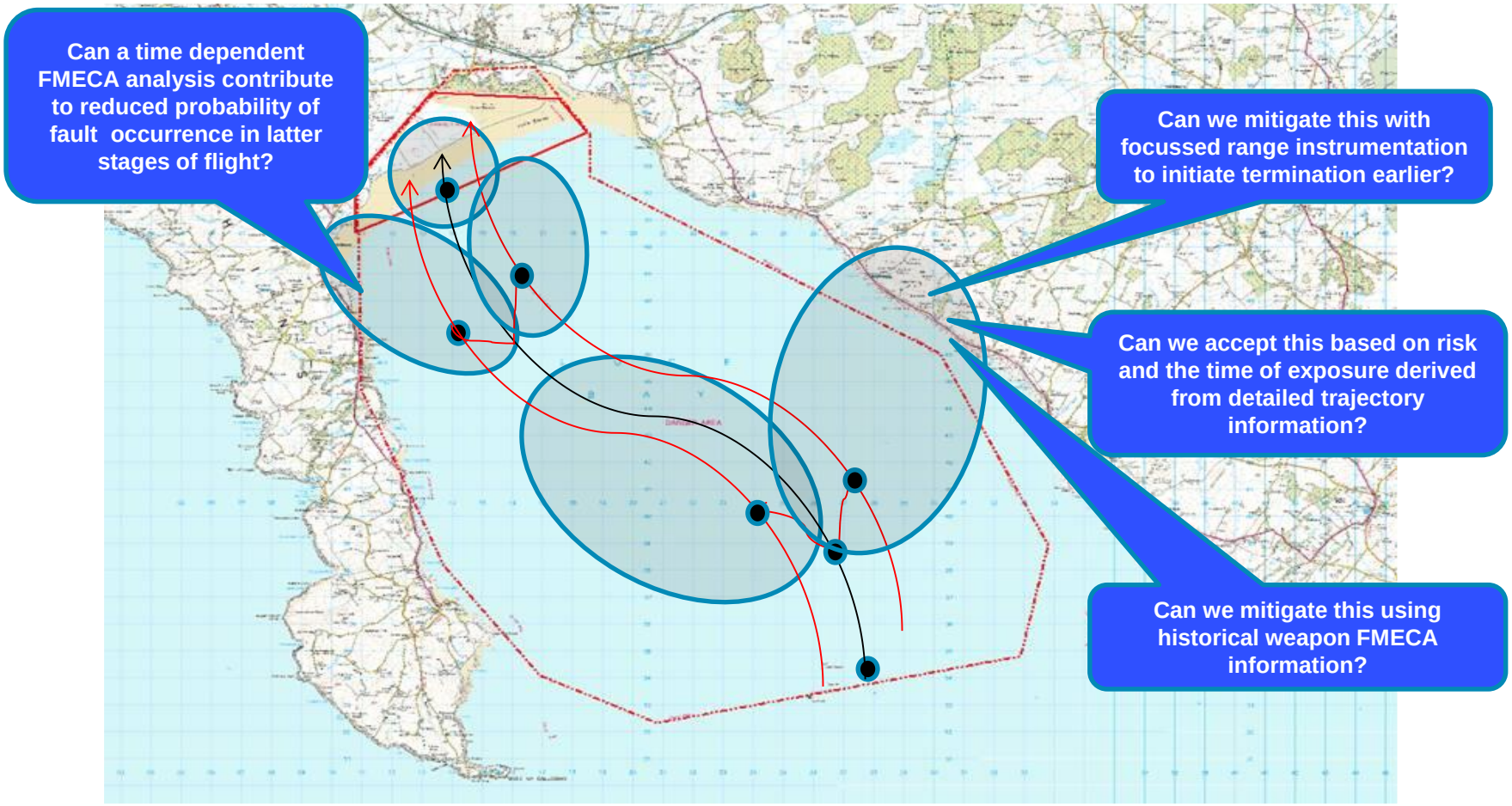
- Deep integration of weapon trajectory, range instrumentation and Flight Termination System (FTS)
- Use of historical system or sub-system fault and failure data
- Definition and implementation of weapon design features

How and when

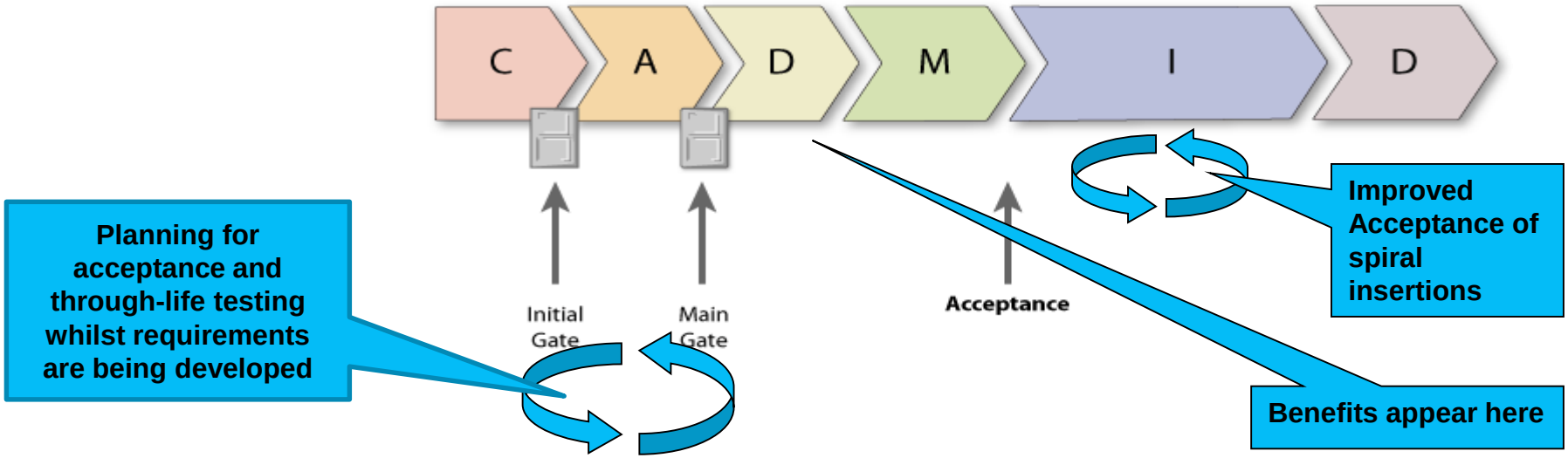
- Deeper engagement between the weapon developer, regulator and range operator to define viable options
- Earlier engagement to allow enablers to cost effective implementation to be acted upon



Adding Time – A Dynamic Weapon Hazard Area



Plan Early



- Consider complete acceptance strategy (inc. simulation and modelling)
- Define DTE strategy and acceptance needs
- Define OTE strategy and needs (TOM & OM)

- Range requirements
- Home vs Overseas range options and costs
- Equipment requirements and costs

'think hard early, do once more effectively'

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Summary - 'think hard early, do once more effectively'

Have suggested that the needs of firing trials could increasingly be met on smaller Ranges through deeper consideration of the goals of the trials and innovative options to reduce the weapon hazard area

Key enablers

- Rigorous consideration of the goal of firing trials within the wider through-life needs of the programme
- Validate the proposed methods to reduce the weapon hazard area
- Confirm that the evidence required to support the methods can be captured
- Early dialogue between User, Regulator, Weapon Developer and Range Operator to identify opportunities

Complex weapons require complex trials and a cultural change to enable trials solutions to be developed with evidence based risk judgements

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Abbreviations

CADMID	Concept, Assessment, Demonstration, Manufacture, In-Service, Disposal
DTE	Development Test and Evaluation
E&T	Evaluation and Test
FMECA	Failure Mode, Effects and Criticality Analysis
FTS	Flight Termination System
LTPA	Long Term Partnering Agreement
OM	Operational Missile
OTE	Operational Test and Evaluation
TOM	Telemetered Operational Missile
w/o	without

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