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Land Sector Programme Defence Research 2010 24th March 2010

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Aims

To provide an update on the Land Sector Research activity within the Defence Technology Plan

To showcase programmes and exploitation of output

The DTP – Practical Model

Defence Technology Strategy



Research Goals
Solution independent, statement of need

R&D Objectives (RDOs)
Programmes to address identified technologies

- Agile Dismounted Close Combat
- Protected Mounted Operations
- Enabling Land Operations
- Manoeuvre Support
- Cost-effective Joint Support Chain

Emerging Technologies / S&T Challenges
Technology push, Threats & opportunities

- Hiding the Complexity of NEC from the Soldier
- Effects & Physical Protection
- Advanced Materials & Structures
- Metamaterials, Micro & Nano Technologies

Capability Visions
Programmes to address 'Left of arc' Defence Challenges

- Reducing the Burden on the Dismounted Soldier
- Future Protected Vehicle

'Roadmaps'

Themes & Activities
Web-based format
Refreshed:

- Unclassified – Feb 10
- Restricted – Dec 09

Industry
DI
HoCs & Embedded Scientists

CPGs/CMGs

TWGs
Non-Cap Stakeholders

Programme Mapping to DTP FY 2010/11 – Land Sector RDOs

Research & Development Objective (RDO)	Research Goals	Themes	Activities
Land			
Agile Dismounted Close Combat	9 (4 Primary, 5 Supporting)	3	15
Protected Mounted Operations	15 (7 Primary, 8 Supporting)	3	15
Enabling Land Operations	11 (8 Primary, 3 Supporting)	4	21
Manoeuvre Support	9 (3 Primary, 6 Supporting)	4	13
Cost-effective Joint Support Chain	15 (12 Primary, 3 Supporting)	4	14
Emerging Technologies and S&T Challenges			
Hiding the Complexity of NEC from the Dismounted Soldier	Cross-cutting	3	8
Effects & Physical Protection	Cross-cutting	4	16
Advanced Materials & Structures	Cross-cutting	2	10
Metamaterials, Micro & Nano Technologies	Cross-cutting	3	6
Capability Visions			
Reducing the Burden on the Dismounted Soldier (RBDS)		5 Tasks	
Future Protected Vehicle (FPV)		5 Tasks	

Operational Priorities - PJHQ

- PJHQ Priorities for S&T in for Force Protection, FY 2010/11:
 - Dismounted Soldier Burden Reduction
 - View Individual and Vehicle as a System
 - Enhance Logistic Vehicle Survivability
 - Improve Vehicle Availability

- Similar priorities for Counter-IED and ISTAR.

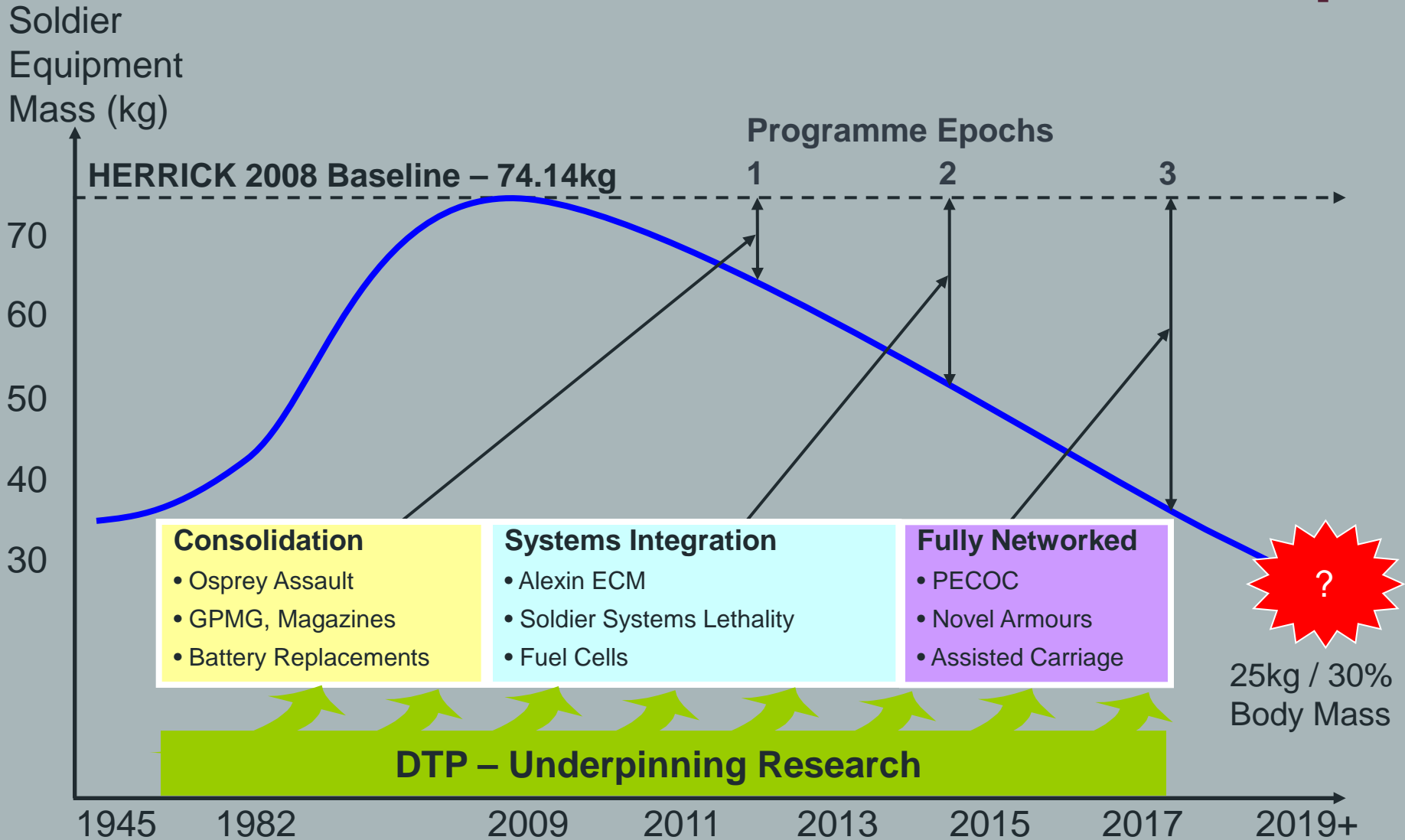


Reducing the Burden on the Dismounted Soldier

- Dramatically reduce the physiological burden
- Scope:
 - A reduction from 70kg to a recommended load of no more than 25kg, with additional improvements in ease of carriage, increased agility and decreased probability of heat stress and dehydration whilst enhancing, the effectiveness and survivability of the tactical unit and individuals contained within
- Prototypes within 2 years
- Experimental Operational Capability from 2011.



Dismounted Close Combat Roadmap

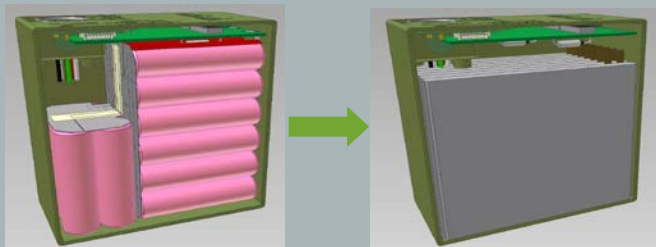


Epoch 1 Technology Candidates



GPMG Weight Reduction, Cranfield

- Consideration of COTS Weapon Systems
- Weapon mass reduction 3.6kg
- Ammunition and link (800) – 6kg mass saving



Permission of ABSL

High Energy 2590 Replacement Li/S Battery, ABSL

- Use novel MMO cathode and polymer packaging
- Rechargeable
- Energy Density ~216Wh/kg
- 25-50% improvement in energy for a packaged battery over traditional Li-ion (2590)
- Could even outperform 5590 primary battery (180Wh/kg)

Epoch 2 Technology Candidates (1)



SA80A3 Weight Reduction, Cranfield

- Mass reduction of Picatinny Rail, replacing with NATO rail
- Trigger mechanism housing mass reduction
- Mass reduction of upper receiver
- Plastic magazine
- Potential total mass saving 0.51kg



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Reformed Methanol Fuel Cell XX55y, ABSL

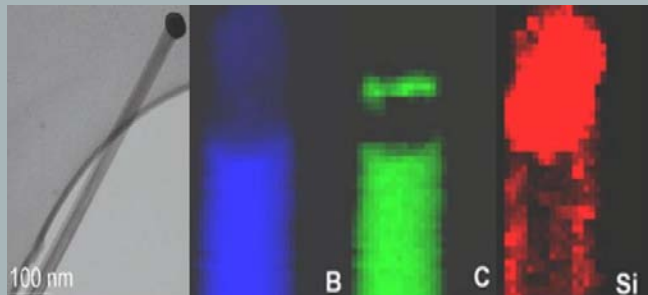
- Could exceed 600Wh/kg target
- Quiet, not silent operation
- System mass 2.5kg mass with 2.0kg methanol/water in low mass cartridges for 12 hour, 150W mission

Epoch 2 Technology Candidates (2)



Ceramic Composite Armour - Sialon, Sheffield Hallam

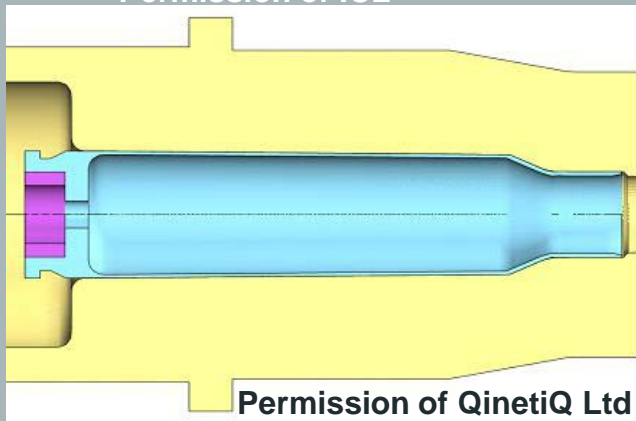
- Silicon, Aluminium, Oxygen & Nitrogen bonded Silicon Carbide composite
- Potentially simpler to produce than fully dense SiC
- 20% lighter than fully dense SiC



Lightweight Ceramics - Boron Carbide (B_4C), ICL

- Synthesis of high quality boron carbide powder avoiding graphitic inclusions, defects and weak polytypes
- High quality boron based armours could be 30% lighter than current ceramics

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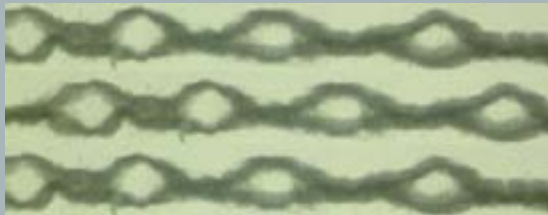
Lightweight Corrosion Resistant Steel Cartridge

Case, QinetiQ Ltd

- Mass reduction 20-40%, depending upon production process and final design

Permission of QinetiQ Ltd

Epoch 3 Technology Candidates (1)



Permission of NIRI Ltd

STF Injected Hydroentangled Soft Body Armour, NIRI Ltd

- Hydrospace materials (novel textile structures)
- Preformed internal cavities with injected Shear Thickening Fluid increase energy absorption
- Could reduce mass of soft armour by 50%



'Fish Scale' Armour, Dstl

- Laminated plates in the form of scales
- Flexible 'soft' armour providing fragment protection
- Air flow may reduce thermal burden
- Trade between 'scale' geometry and protection to optimise air flow without introducing ballistic 'windows'



'Solar Soldier', Glasgow, Reading, Leeds, Strathclyde, Brunel & Loughborough Universities

- Multilayer Photo Voltaic-Thermo Electric device scavenging solar and thermal sources into a single array
- Coupled to optimised storage media integrated into a flexible and robust system

Epoch 3 Technology Candidates (2)



Data and Power Transfer Vest, Intelligent Textiles

- Woven conductors allow power and data distribution without cables
- Lightest approach to a power system
- Redundancy in conduction paths
- No cable snagging

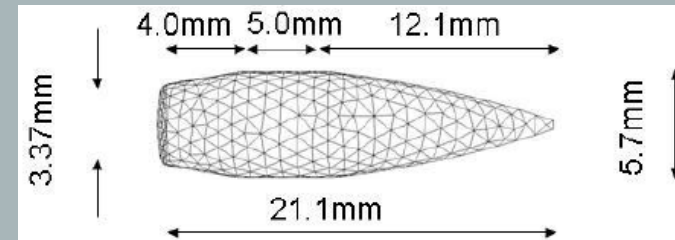


Assisted Carriage System, Boeing Defence UK

- Payload approx 600kg
- 3 systems per Platoon
- Saving 10-15kg per man
- Extends mission time

Novel Bullet Design, QinetiQ Ltd

- Potential for 50% weight saving

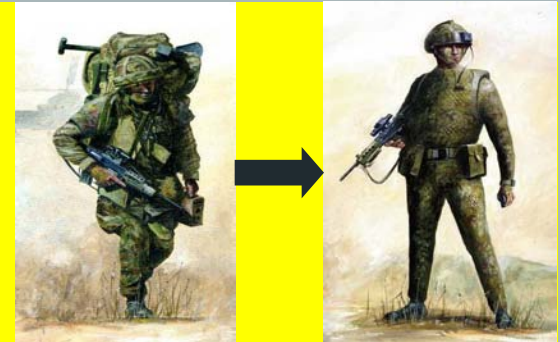


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Systems Integration & Architecture

Soldier CV Technology Integration:

- Task 1 – Lightweight Personal Protection
- Task 2 – Lightweight Weapons Systems
- Task 3 – Energy Efficient Soldier
- Task 4 – Assisted Carriage System



Integration

Stakeholder Community:

Cap GM
 PJHQ
 DInf, ITDU, LWC
 DE&S - ICG, FP, Wpns, PTG
 DTIC, Dstl



Soldier Systems Architecture
 Team CENTAUR - SEA, Roke, SCS, SDE
 with 7 affiliate companies and 4 Universities

New Ways of Working
 Integrated operation with DE&S ISSE

- MDAL
- SEMP
- Requirements Traceability

- SRD
- Equipment Sets / Masses
- Exploitation / Roadmaps

- Soldier Systems Architecture
- Standards & Interface Definition

Soldier CV Overall Progress

- Complex delivery programme launched February 2009, on schedule:
 - Broad Innovation 'front' leading to Technology PoPs:
 - 28 CDE contracts placed ~£1.2M (from 4 seminars, 100 proposals):
 - 5 ideas funded through Dstl internal call
 - 4 PoPs funded through MAST call
 - Major competitions:
 - ~200 PQQs issued leading to 3 FATS sourced contracts
 - SEA, BDUK and Cranfield leading large consortia and making good progress
 - Underpinning research programme:
 - 4 research programmes joint funded with EPSRC
- Ways of working:
 - Joint working with ISSE in DE&S Individual Capability Group
 - Full Stakeholder engagement with User Experiments out to March 2011
 - Key Stakeholder reviews in the next 1-2 months
- Benefits: Potential burden savings identified, but yet to be quantified through full exploitation in the UK Equipment Programme.

Gun Shot Locator



- Determines range and bearing of hostile fire using frequency domain processing on the bullet shockwave and muzzle blast
- Rifle Mounted Sniper Locator (RMSL):
 - Competition of Ideas funded Ultra Electronics (complete August 2009)
 - From mathematical model to robust prototype (triated by soldiers on Salisbury Plain) in 21 Months
 - Solutions to overcome performance issues in wet and high wind conditions identified and incorporated
 - Successful in down-selection firing trials on Counter Fires programme for a Soldier Wearable Shot Detection System
- DE&S PTG developing the technology for complex multi-path/shot applications (ie. Urban) as part of a demonstrator programme in FY 2010/11.



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- Heavy Equipment Transporter



- Weapons Mounted Installation Kit

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Vehicle Technology Integration Demonstration (VTID)

- Aim: To quantify and demonstrate the utility of integrated survivability (other than physical armour) in respect of mounted close combat platforms, to counter the perceived threats in a range of representative scenarios
- Programme scope included:
 - Integrated Survivability (IS) & Infrastructure Concepts
 - Mission Modularity
 - Modular Dependability
 - Physical Integration of a range of technologies: LSA and Acoustic Sensors, LWR, RWS, Obscurants, etc
 - Demonstration of IS concepts in different military scenarios
- It was more than an Electronic Architecture, and included:
 - Mechanical and Power architectures
 - Human Machine Interface assessment of Users in System Integration Labs
 - Support Infrastructure
 - Decision Agility
 - Certification.

VTID Programme Achievements











- There are no technical barriers to implementing an architecture with the required characteristics
- An underpinning Integrated Survivability architecture will:
 - Enable a number of configurations/mission ‘fits’
 - Reduce the time that soldiers are exposed to new threats and reduce casualties
 - Provide a key enabler for agile Technology Insertion and TLCM
- Modular Certification is a key enabler
- If significant changes are made through life there will be an overall cost saving
- The time to mandate an Integrated Survivability architecture is now.

VTID Programme Exploitation

- The products of the programme have informed MoD of the advantages and optimised solutions for Integrated Survivability on both new and legacy platforms, and in turn aid the preparation of equipment and future research requirements
- Exploitation products:
 - MoD access to FV432 based Demonstrator
 - CD with over 40 reports
 - Through life cost model
- These have been made available to:
 - DE&S Delivery Teams
 - Vehicle Systems Integration (VSI)
 - Generic Vehicle Architecture (GVA)
 - Analysis and studies to support Decision making.



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Force Protection Engineering (FPE)

- Consortium led by QinetiQ includes Cranfield and Sheffield Universities, Transport Research Laboratory, Frazer-Nash Consultancy, Dstl, SEA
- Collaboration:
 - Links with OGDs: CPNI, HOSDB, HSL, DfT
 - Excellent international links
- Research exploitation:
 - Hesco Accommodation Bunkers (HABs) with enhanced levels of protection for its occupants
 - Research trials using rockets and mortars
 - Exchange of information with IRC partners
 - 180 HABs have already been delivered to FOBs (Op HERRICK), a further delivery of 80-100 envisaged.



Vehicle Solar Load Heating Reduction

■ On current Operations vehicle interiors get very hot and surface temperatures can exceed 75°C, which:

- Impacts Habitability
- Increases burden on Vehicle Occupants
- Compromises Signature
- Increases load on Air Conditioning and wastes fuel



Permission of Team MAST

■ Approach:

- 3 Coating systems to reduce solar heating effects were evaluated
- Formulated as peelable coatings from COTS supply on FV432 (Baseline)
- Solar loading trials in chambers, Visual and NIR trials in the field
- Measured insulation and solar heat reflecting properties in the coating system
- Compared with current light stone paint finishes (BSI 381c)

■ Benefits:

- Novel coatings yielded a 5°C exterior and a 1.5°C interior temperature reductions compared with current coatings
- Visible, NIR and thermal signature have also been evaluated.



Sustainability & Availability - Context

- Low Operational Availability of equipment:
 - Increased weight:
 - Warrior MDBF reduces by ~40% when mass increased from 30 to 35T
 - Demanding terrain, different duty cycle
 - High altitude and demanding climates
 - Availability of spares and repair facilities
 - Mastiff availability reported at 20%
- Repair of damaged platforms:
 - Repair techniques
 - Cost-effectiveness of in-theatre repair vs return to UK
 - Assessing integrity of repaired vehicles
- Reducing the logistic footprint:
 - To include effects of User Training, Enemy Action, and the lack of spares or forward repair facility.



Sustainability & Availability - Programme

■ Aims:

- Improved Operational Availability through improved reliability and reduced downtime
- Improved repair and test, including in-theatre
- Reduced logistic footprint

■ New programme:

- Scoping activity:
 - Stakeholder and current activity engagement
 - Data collection: Duty cycles, terrain, reliability
- Innovation - CDE
- Delivery – FATS based competition

■ Exploitation and Outputs:

- Quick wins for current operations
- Input to HUMS strategy and Defence Standard
- New technologies for UOR and future programmes
- Improved definition of duty cycles for future equipments



Future Protected Vehicle Capability Vision – Revised Programme

- No change to:
 - Task 1 – Systems Studies
 - Innovation Channel
- Revised programme:
 - Virtual Phase
 - Details to follow



Conclusions

- **Land Sector Research Programme:**
 - Strongly focused on supporting current operations in Afghanistan with significant exploitation achievements
 - Geared to support the longer term UK Equipment Programme and to provide decision support
 - Constructed where possible to support UK industrial capability by building effective consortia comprising Primes, SMEs and Academia
 - High Innovation through CDE and Capability Visions
- **Dstl Programme Office from April 2010.**
 - Programme or Technical Issues
 - 01980 658055 or programmeoffice@dstl.gov.uk
 - Contractual or Commercial Issues
 - DSTL Commercial Services 01980 658298 or csenquiries@dstl.gov.uk

Questions



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