



Disruptive Science & Technology

Taking The Battle To The Enemy

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Content

Why we invest in S&T, and what are the challenges ?

Examples of S&T exploitation.

Innovation in S&T acquisition.

Questions.



To start ...

Proposition #1

- The only difference between the old equipment and the new is science and technology.



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Proposition #2

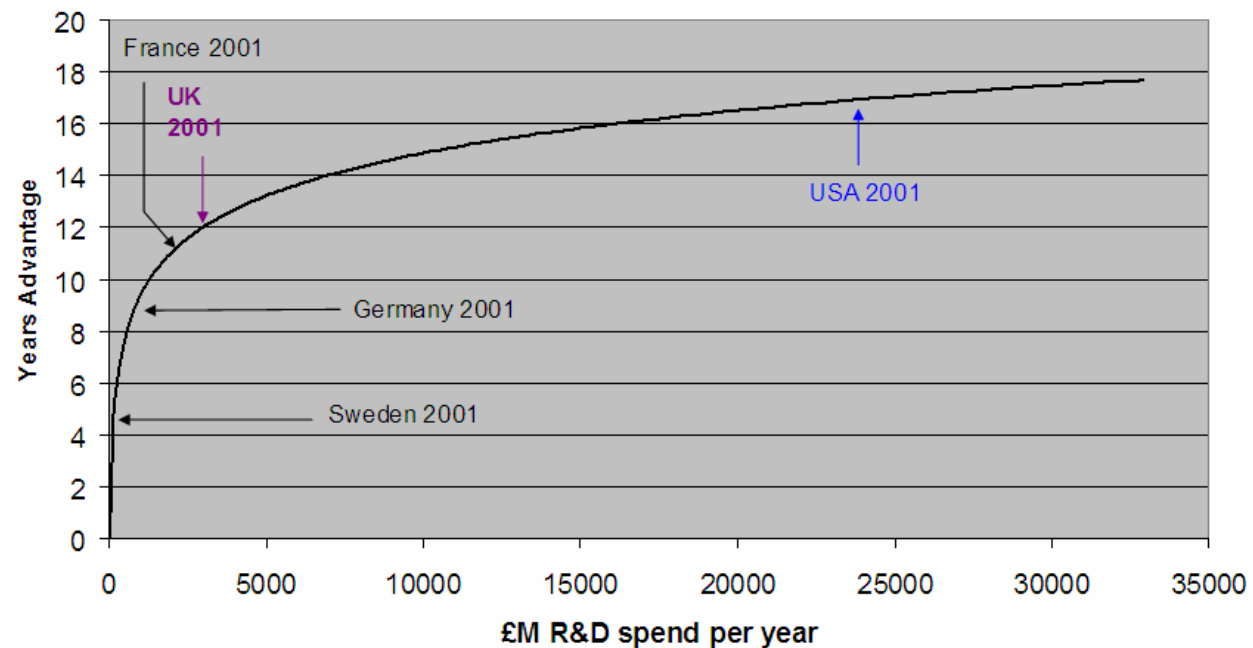
- Whilst replacing old equipment with new gives incremental advantage, the world's best sword is no match for the smart munition.





Proposition #3

- Equipment advantage (based on new S&T) only buys you time. An agile, determined and capable enemy will close the gap.



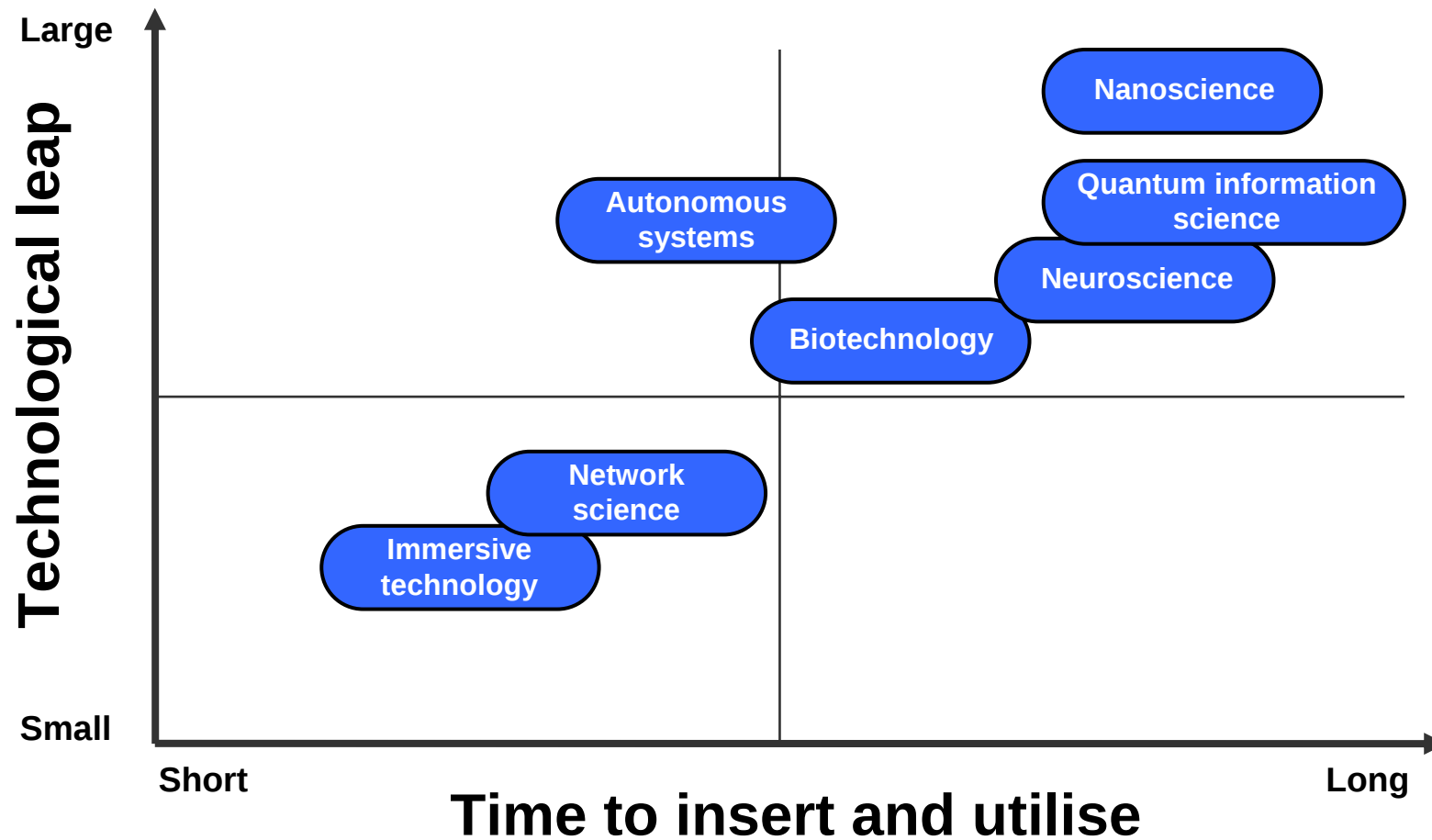
The Effect of Defence R&D on Military Equipment Quality
Middleton, Bowns, Hartley, Reid
Defence and Peace Economics, 17(2), Apr 2006

Technological Superiority



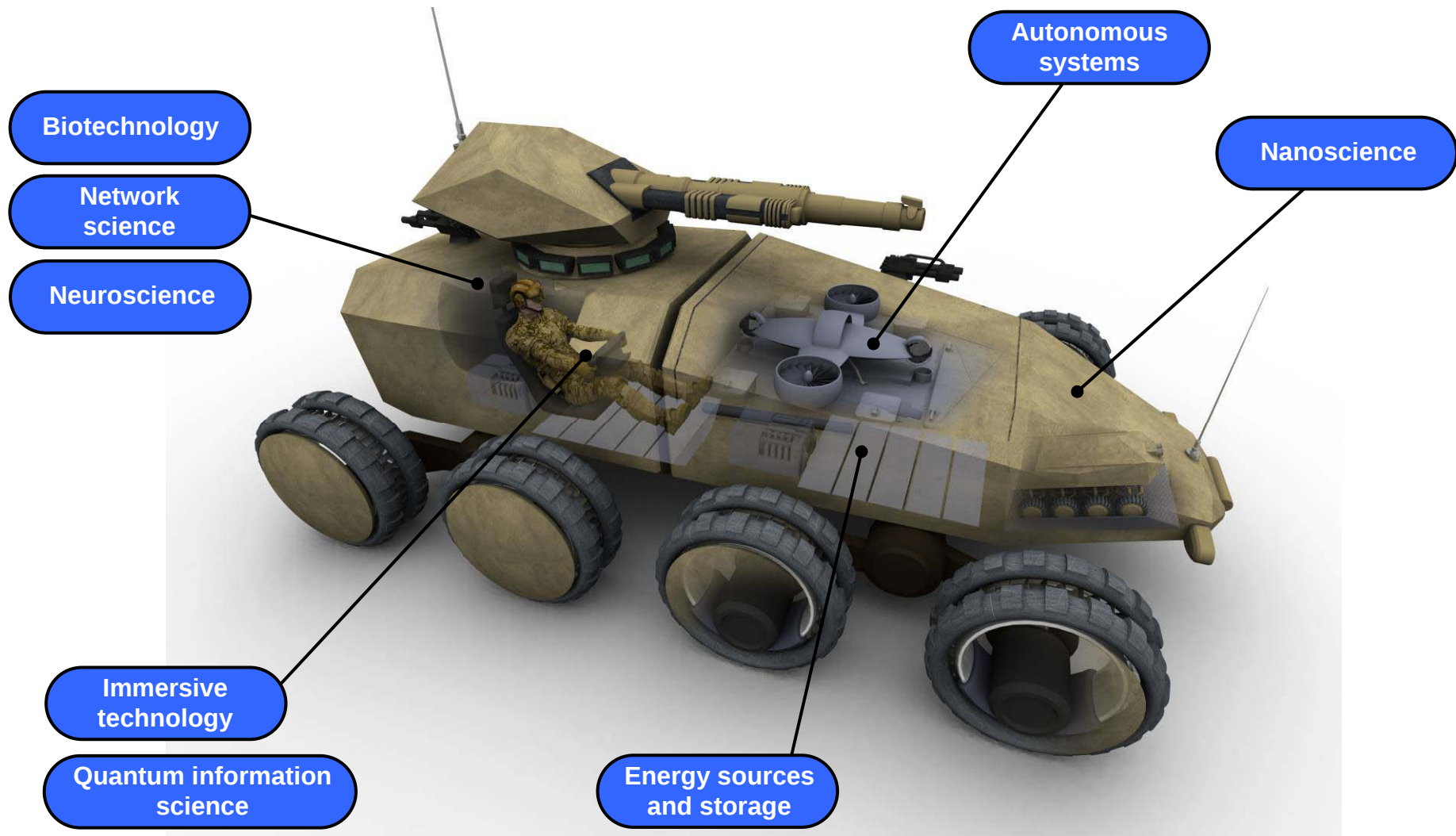


Example Technologies

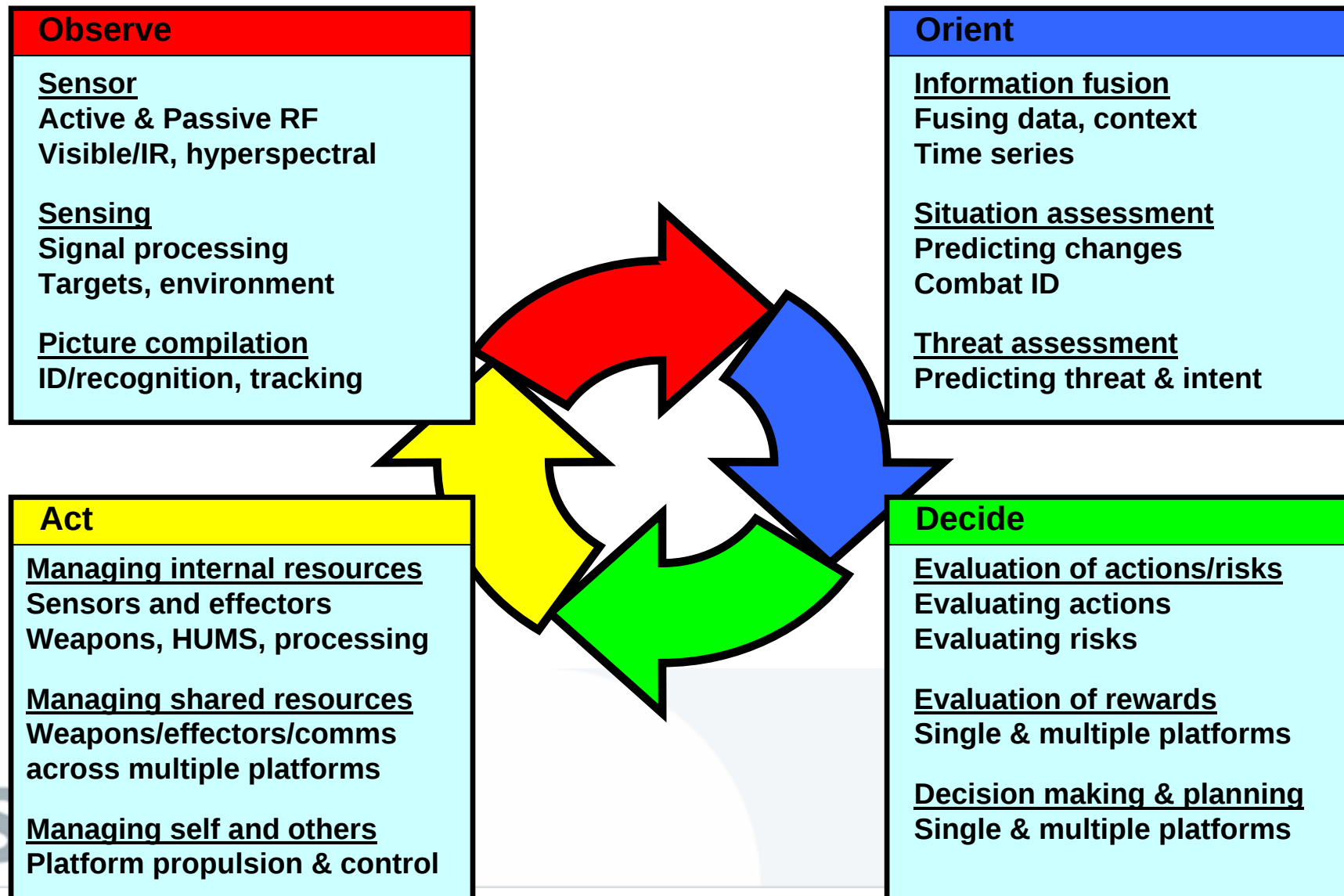




Example Technologies



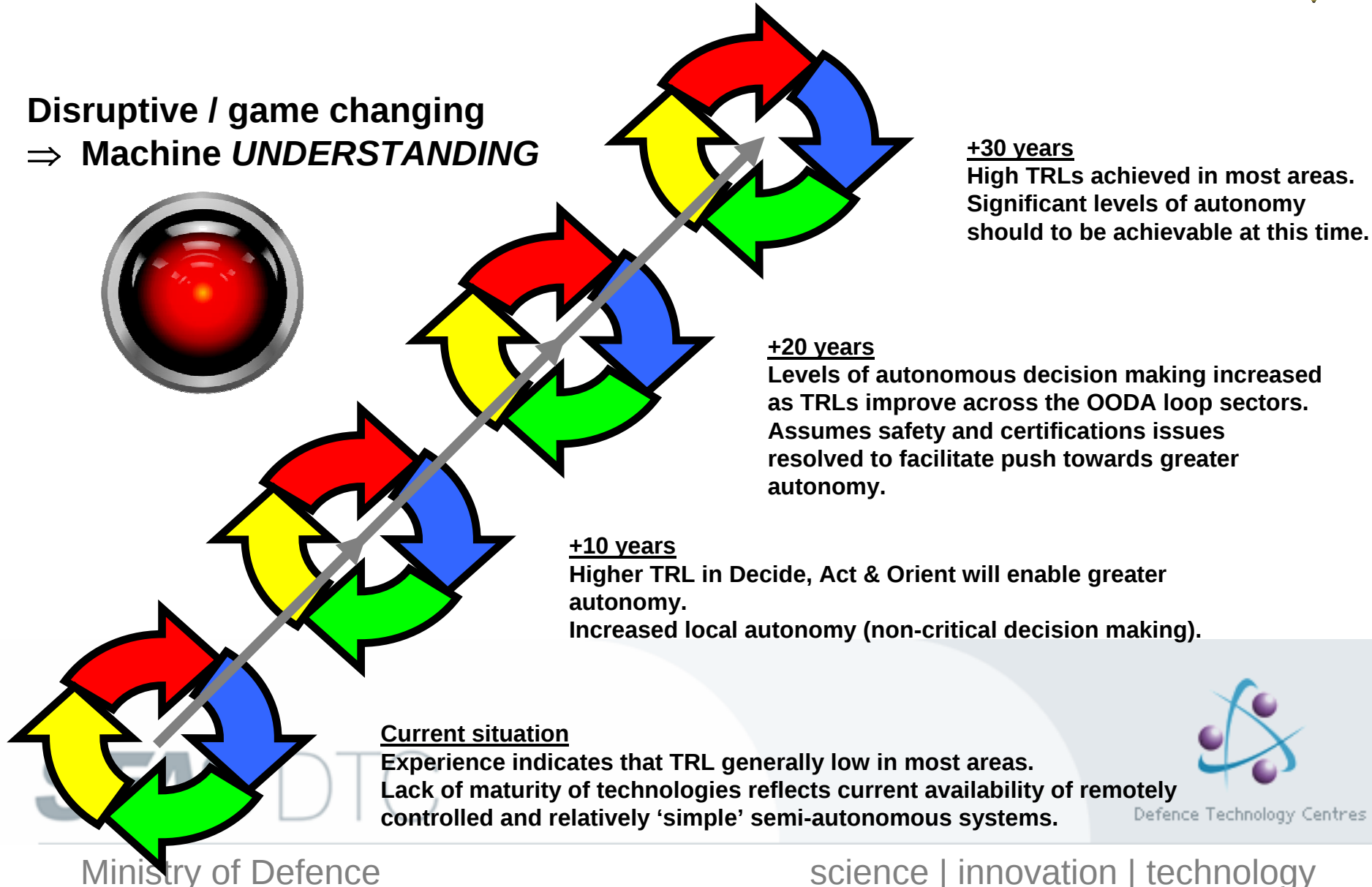
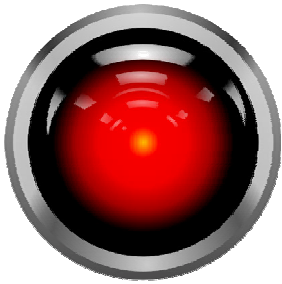
Autonomy in the Land Domain



An Autonomy Roadmap



Disruptive / game changing
⇒ Machine *UNDERSTANDING*



Defence Technology Centres

Autonomy Enablers



	Current	+10 years	+20 years	+30 years	
Platform	System Architecture Systems Engineering System - Hardware System - Software Design Memory / Learning	System Architecture Systems Engineering System - Hardware System - Software Design Memory / Learning	System Architecture Systems Engineering System - Hardware System - Software Design Memory / Learning	System Architecture Systems Engineering System - Hardware System - Software Design Memory / Learning	TRL = 9 6 ≤TRL < 9 3 ≤TRL < 6 TRL < 3
User interactions	Human Factors	Human Factors	Human Factors	Human Factors	
Interactions with other platforms	Network Infrastructures Network Architecture Network Integration Comms Mgmt Distributed Info Processing Distributed Control	Network Infrastructures Network Architecture Network Integration Comms Mgmt Distributed Info Processing Distributed Control	Network Infrastructures Network Architecture Network Integration Comms Mgmt Distributed Info Processing Distributed Control	Network Infrastructures Network Architecture Network Integration Comms Mgmt Distributed Info Processing Distributed Control	
Environmental	World Representation Managing uncertainty	World Representation Managing uncertainty	World Representation Managing uncertainty	World Representation Managing uncertainty	

SEAS DTC



Defence Technology Centres

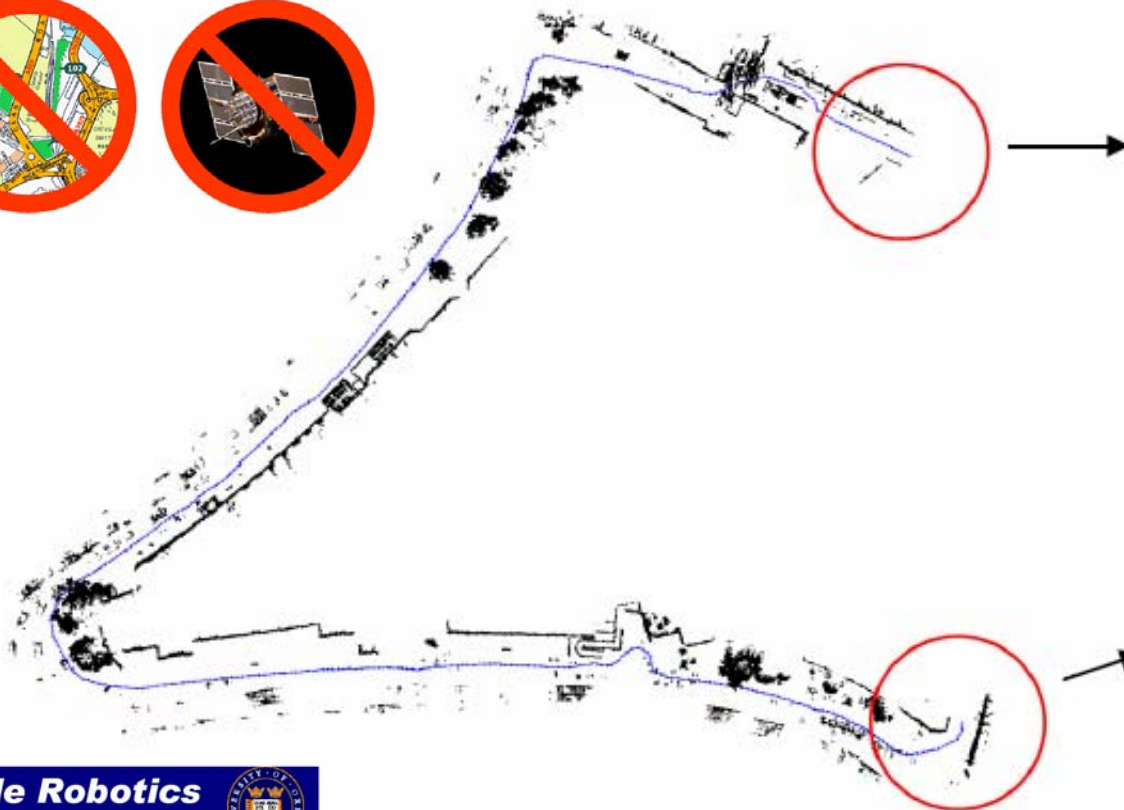
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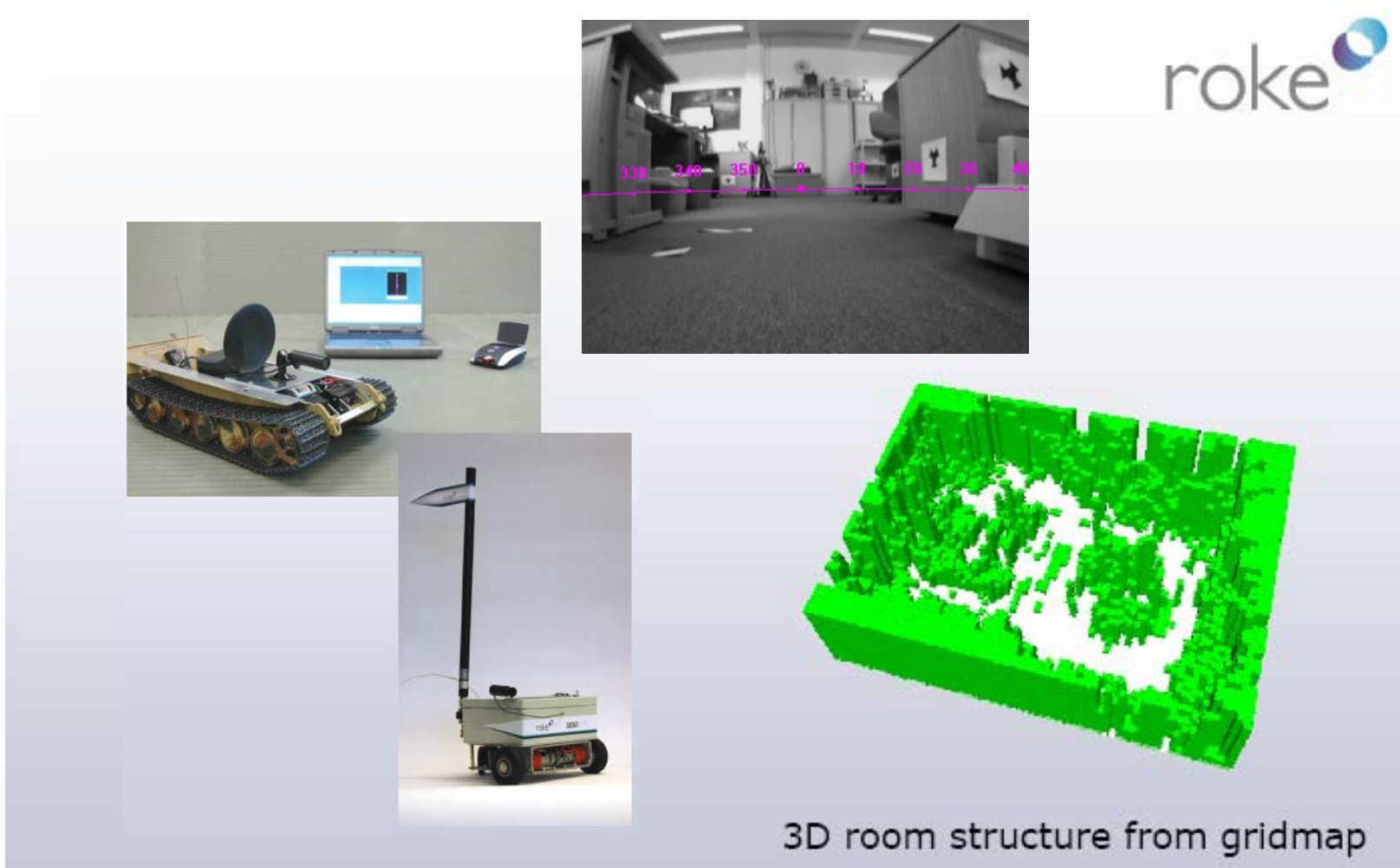


Appearance-Based Mapping & Navigation in Urban Environments

Appearance information can detect loop closure where metric approaches may fail.



Autonomous Exploration & Mapping of an Indoor Environment





Armour

- PARSIFAL
 - A programme of UOR activity to improve the protection of a range of armoured vehicles as well as personnel.





Zephyr HALE UAV

- Yuma Proving Ground, July-August 08
 - UK MOD S&T funding
 - US JCTD funding (OSD AS&C)
 - CENTCOM sponsor, SMDC support
 - Z6.2 airframe: 82½ hrs, 61778ft altitude
 - Z6.1 airframe: 100 hrs
 - Demonstrated 300 mile 2-way comms relay
 - BLOS telecommand over Iridium
- Z6 aircraft met performance predictions
 - Providing flight test data that increases confidence in Z7 aerodynamic modelling and design tools
 - Significant de-risking of Z7 subsystems
 - Power, propulsion and thermal design



Portable Power

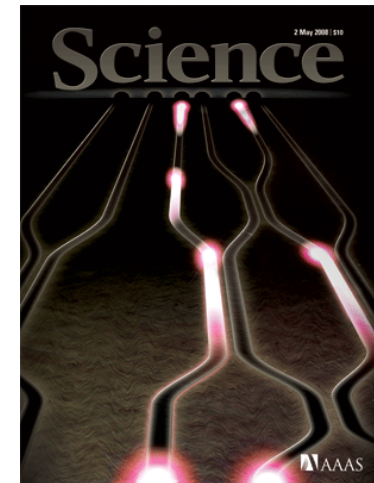
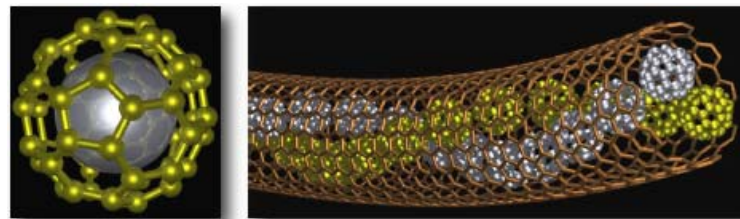
- £5m programme to develop two soldier power sources to TRL 7
- Strand 1: Small, light, low power, high energy density
 - 7.2W (30W peak), 48 hr, 300Wh/kg
 - Reformed methanol fuel cell chosen
 - Partnering with UltraCell
 - Current status
 - 15W fuel cell engine
 - Prototype electronics breadboard designed
- Strand 2: Mid size, lightweight, high power, high energy density
 - 100W (150W peak), 1200 Whr, 333Wh/kg
 - Hydrogen fuel cell with ammonia borane hydrogen store
 - Partnering with Jadoo Power Systems Inc.
 - Current status
 - H2 generator demonstrated peak power 80W at system level
 - System designed





Quantum Information Processing Interdisciplinary Research Collaboration

- QIP IRC is a UK national collaboration involving 10 universities and 5 industries. It started in 2004, and will continue until 2009.
- The scientific goals are:
 - The development of novel approaches for the controlled generation and entanglement of two or more qubits
 - The development of methods for efficient transfer of quantum information between static and propagating qubits
- These objectives include theoretical analysis of new methods of manipulation and transfer between qubits of the same or different types, and also their experimental design and implementation.



EPSRC

Engineering and Physical Sciences
Research Council

Ministry of Defence

QIRC

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Immersive Training



- **Virtual Battlespace (VBS) 2 for pre-deployment training**

- Player & instructor stations
 - Driver, commander and top gunner
 - Voice over IP or PRR or Motorola communications
- A number of scenarios including
 - IED & VBIED, ambush (small arms and RPG), civilian crowds, coalition flanking forces
- Recordable after action review





Blended Live/Synthetic Training

- A Canadian Study looked at the influence VBS had on their Armour School's Troop Warrant Officers course.
- Serial 0702 cost ~ 33% less through reductions in fuel, etc., and drove the pass rate up from 72% to 100% compared to purely live training.
- Only one day of VBS took the pass rate to 30%.
- The new blended live/simulation mix reduced the cost to train (and qualify) each trainee by about a half.

	Serial 0602 (No VBS [®])	Serial 0701 (1 day VBS [®])	Serial 0702 (2.5 weeks VBS [®])
% pass on 1 st trace	0	30%	67%
% pass by 1/2 of traces	61%	72%	100%
% pass by end of course	72%	83%	100%



Figure 5: VBS 2⁺ Workstations in the Armour School Battle Lab (Hill 2008)

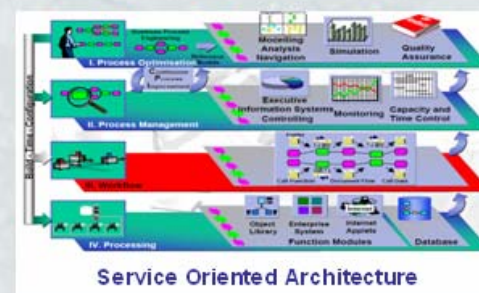
I/ITSEC Conference 2008 Paper
Games – Just How Serious Are They ?
Dr. Paul A. Roman Mr. Doug Brown



The International Technology Alliance



Network Theory (TA1)



Sensor Information Processing and Delivery (TA3)

Security Across a System-of-Systems (TA2)



Distributed Coalition Planning and Decision Making (TA4)

Innovation Strategy



SHARING THE VISION

Defence Technology Plan.

Publish forward looking EP.

ROAD MAPPING

Development of
Technology Road Maps.

NEED FOR SPEED

Standard terms of business to streamline R&D contracting process.

Review Innovative Proposals in Timely Fashion.

SYSTEMS ENGINEERING

Encourage adaptable systems and
open architectures where appropriate.

Research Concept Demonstrators.

BUSINESS MODELS

Defence Enterprise Centres.

Work with NDIC to develop
new business models.



MOD Grand Challenge



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