Australian Government
Department of Defence
Defence Science and
Technology Organisation

Weapons and Combat Systems Division

Dr John Riley
Chief
Weapons and Combat Systems Division

Weapons and Combat Systems Division

Vision: To be at the forefront of the application of science and technology to tactical warfighting systems and operations.

Mission: Delivering a capability edge to the tactical war fighter.

Strategy:

- Focus on the Tactical Engagement
  - Warfighter (Human Systems Integration)
  - Tactical Systems
  - Complex Future Warfighting Environment
    - Current and Future Threat
    - Complex EM Environment
  - Understand ADF tactical capability against future threats in a complex contested environment.
- Focus on Future Weapons and Combat/Mission System Technology

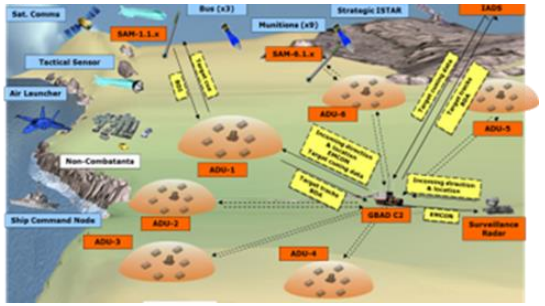
Weapons and Combat Systems Division (WCSD)

• Advanced Modelling and Simulation • Weapons Modelling and Analysis • Combat Systems Effectiveness and Analysis	• EO Sensors and Processing • RF Sensors and Processing • Guided System Technologies and Evaluation	• Electronic Systems Integration • Information Processing and Human Sciences • Information Architectures and Networking	• S&T Program coordination • Divisional Operations • Work Health Safety, Security, Facilities	• Land Weapons Technologies • Weapons Effects and Protection	• Explosives and Pyrotechnics • Weapons Propulsion	• Analysis of Threat Systems • Developing S&T capability to deliver on Intelligence requirements • Support ADF platforms and personnel

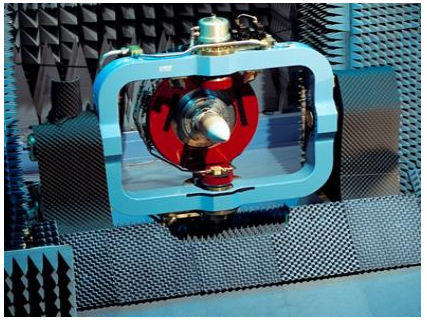
WCSD Major Science and Technology Capabilities

Combat and Mission Systems: Develops combat and mission systems for maritime and airborne platforms, and the tactical networking between air, sea and land platforms.

Weapons and Combat Systems Assessment: Assess individual weapon system performance and end-to-end tactical system effectiveness.



Weapons Guidance Technology: Undertakes research, development and analysis of the guidance systems of modern weapons.



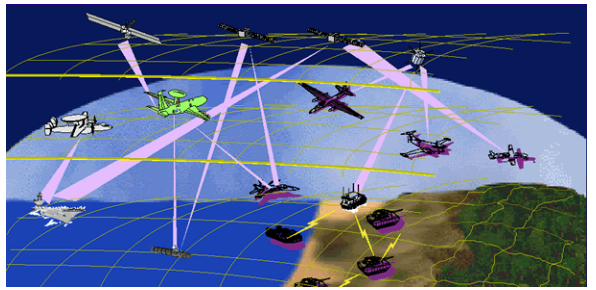
WCSD Major Science and Technology Capabilities

Energetic Materials and Systems: Research into the an understanding of energetic materials and systems: explosives, pyrotechnics, propulsion systems.

Land Weapons Systems and Effects: Supports all aspects of ADF unguided weapons and the effects that weapons have on platforms and personnel.

WCSD Programs

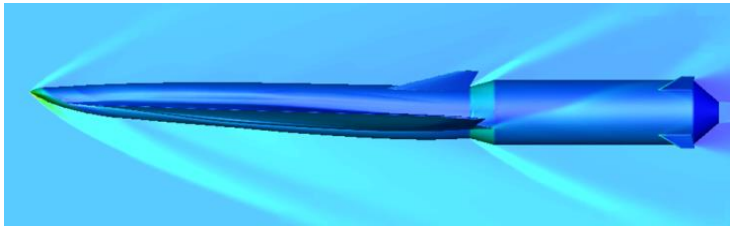
Weapons Systems Technical Intelligence



Shape and Sustain the ADF Capability

Succeed in Complex Contested Environments

Emerging Weapons Technology



Counter Improvised Explosive Devices

Partnership Objectives

- Foster support for open systems approaches to the development and acquisition of tactical systems
- Systems approach to the problem of countering Improvised Explosive Devices (Defence + National Sec Applications)
- Protection of people and structures against explosive events
- Centre of Expertise in Energetic Materials (CEEM) - World class centre of national significance
- Human Systems Integration
- Advanced Modelling and Simulation technologies
- Sustainment of current weapons (safety and life of type)
- Future Weapon Systems

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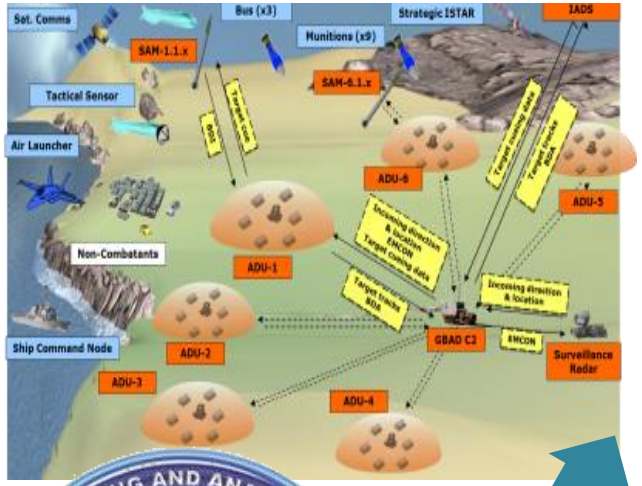
One World Modelling and Simulation Architectures

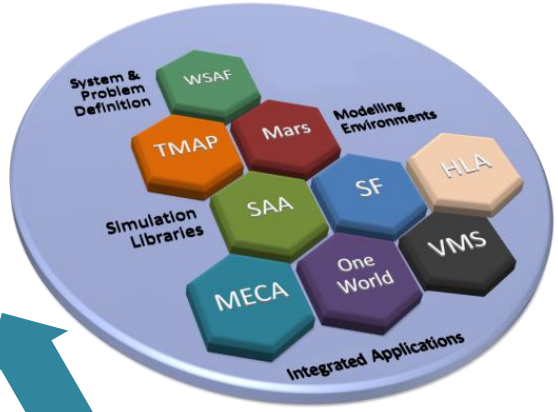
Weapons and Combat Systems Assessment

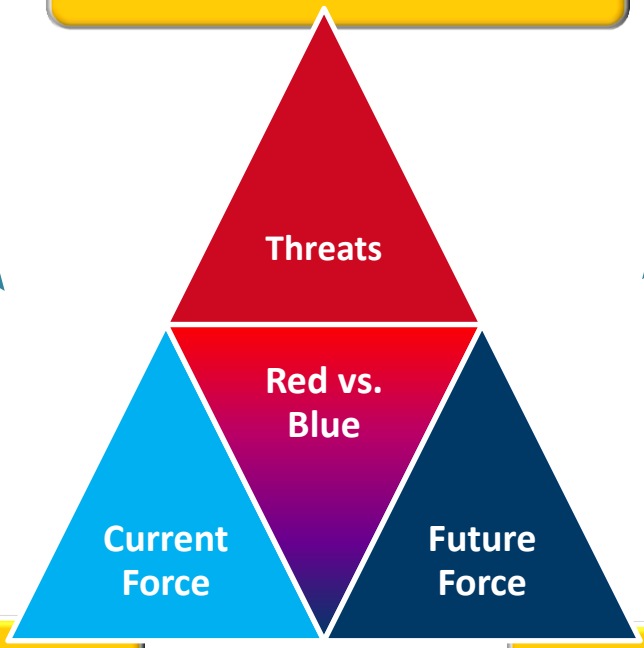
Presented by: Mr Lloyd Damp

Weapons and Combat Systems Assessment MSTC



Combat Systems Effectiveness Analysis





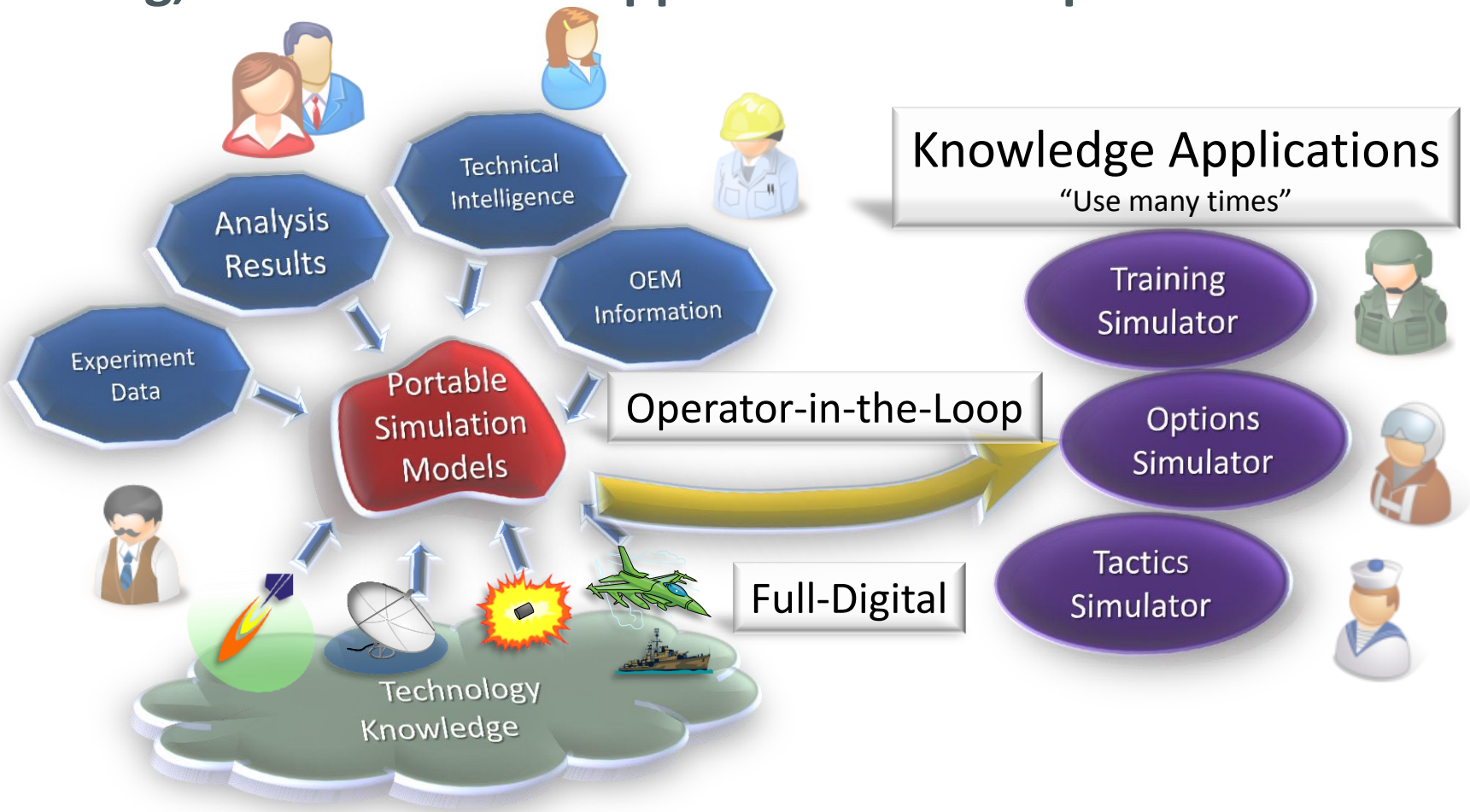
Weapons Modelling and Analysis

Advanced Modelling and Simulation

Modelling, Simulation and Application Philosophies

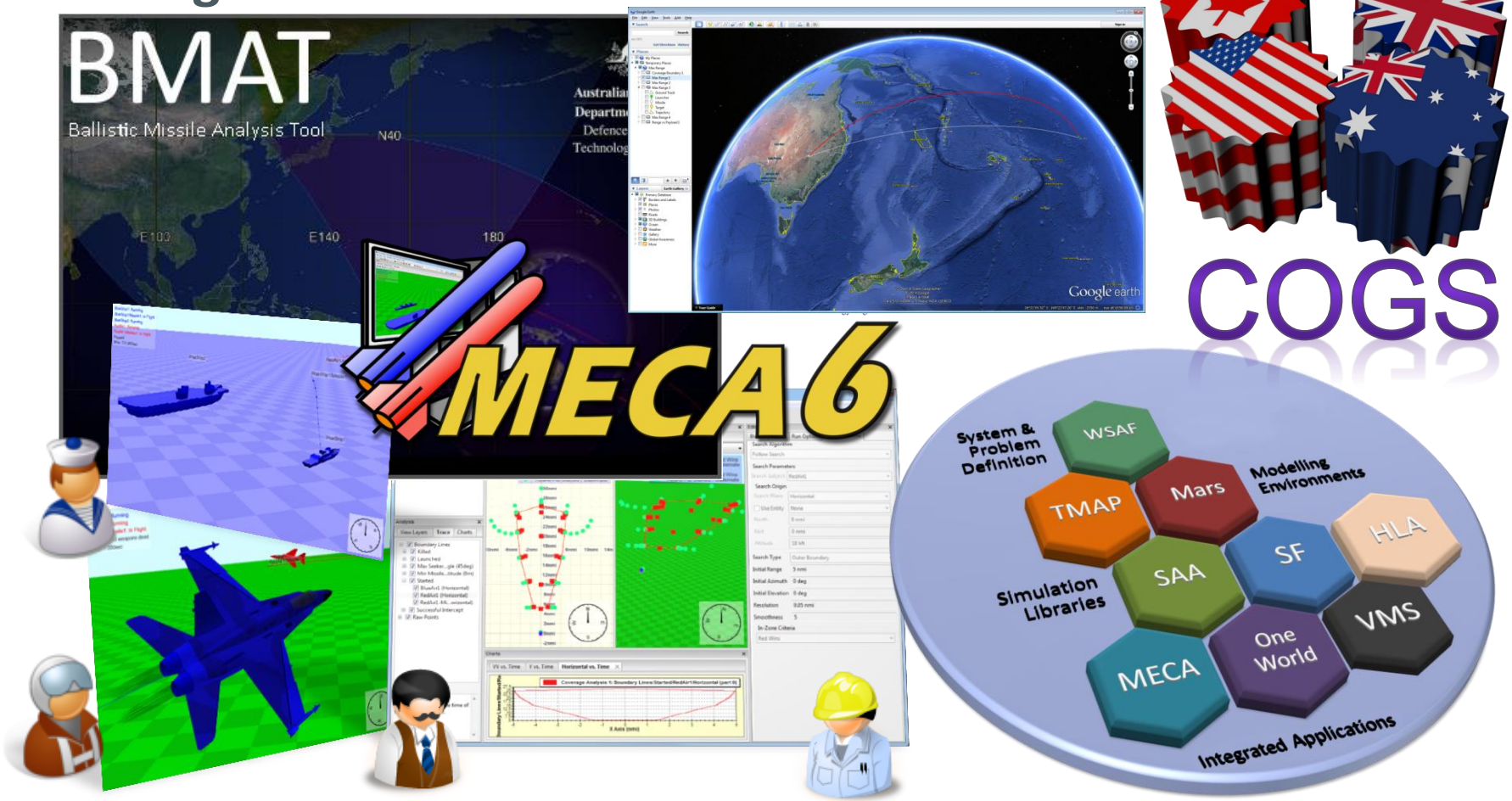
Knowledge Capture & Integration

"Capture once"



Opportunities exist to partner to ensure knowledge portability through the definition of interfaces and standards

Full-Digital Simulations



Opportunities exist to partner in the creation of models architectures and applications

Operator-In-The-Loop Simulations

- High fidelity hardware, simulated environments and customisable scenarios
- Integrate and test new algorithms, equipment or services
- Optimise Operator-Machine effectiveness
- Ability to integrate into any stage of the engagement chain

Threat Environment → Sensors → Combat System → Decision Agent → Effector(s) → BDA

Opportunities exist to partner together on Operator-In-the-Loop simulation environment development

Come Partner With WCSA Branch!

Our Partnering can develop the best outcome for You and Defence!

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Combat and Mission Systems Partnering Opportunities

Combat and Mission Systems

Presented by: Dr Shane Canney

Combat and Mission Systems Branch - Overview

To become the tactical systems integration S&T focal point for enhancing ADF warfighting capability

Current Force

8 FFHs (ANZAC)

6 AEW&C

Force-In-Acquisition

8 ASMD ANZACs

8 P-8As

6 AEW&C+

3 DDGs

72 JSF

Future Force

Future Frigates

P-8As

Future AEW&C

MUAS

72 JSF+

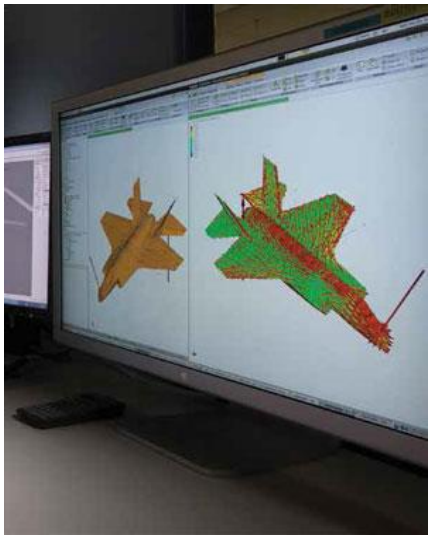
Upgraded DDGs

Combat and Mission Systems MSTC

- Electronic Systems Integration STC
- Information Processing and Human Systems STC
- Information Architectures and Networking STC

Partnership Opportunities – Electronic Systems Integration

Electromagnetic Environmental Effects (E3) considers the compatibility of a military platform with its external electromagnetic environment. This includes lightning, telecommunications and radars, (inter-system compatibility) and between the electronic systems on-board the platform (intra-system compatibility).



Collaboration opportunities exist in E3 computational modelling/analysis and the development of novel test/measurement methodologies.

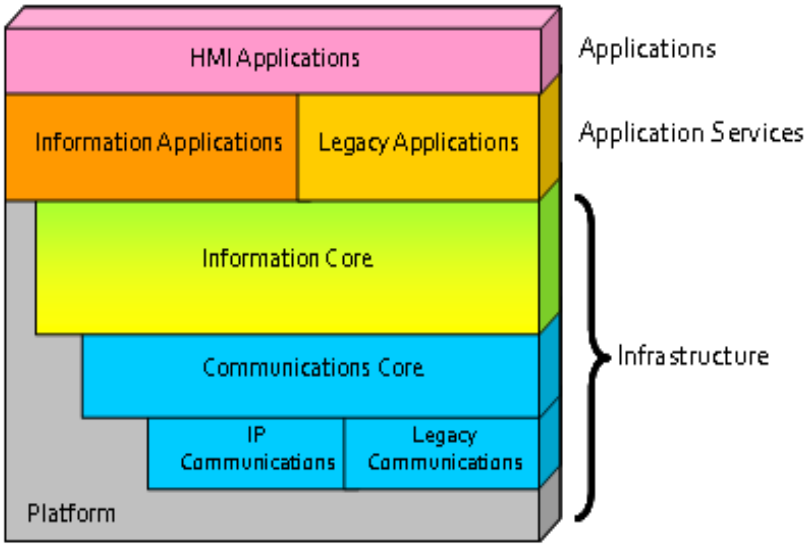
Partnership Opportunities – Information Processing and Human Systems

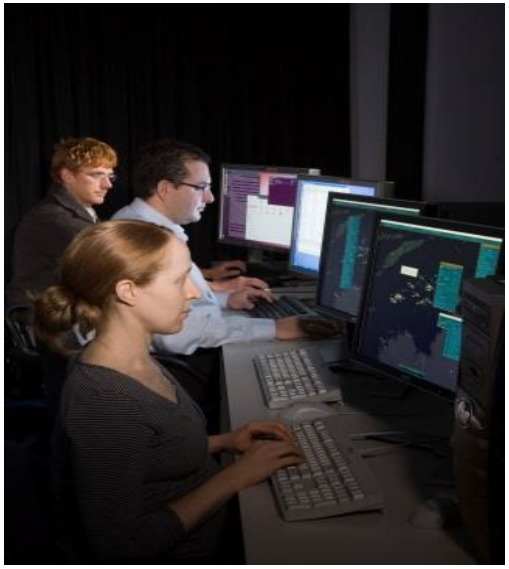
DSTO undertakes research **to underpin operator decision making** in tactical situation assessment, threat evaluation, effect and weapon assignment and resource management. User-centred design techniques are employed to improve warfighting through effective **design of interfaces and the physical environment.**

Collaboration opportunities exist in the development and implementation of concepts and tools to aid warfighter decision-making and in user-centred design, in particular advanced display concepts.

Partnership Opportunities – Information Architectures and Networking

DSTO conducts world-leading research on **emerging information architectures and networking technologies** for next generation combat and mission systems.





Consider joining our team of international partners working towards the shared goal of seamless information exchange throughout the tactical battlespace and the wider Defence enterprise.

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Weapons Guidance Technologies Partnership Opportunities

Weapons Guidance Technology

Presented by: Dr Peter Gerhardy

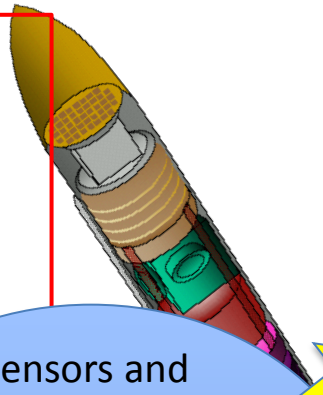
DSTO | Science and Technology for Safeguarding Australia

Weapons Guidance Technology Branch

To provide clear and identifiable support to the ADF capability advantage through detailed knowledge of the development and application of weapons guidance.

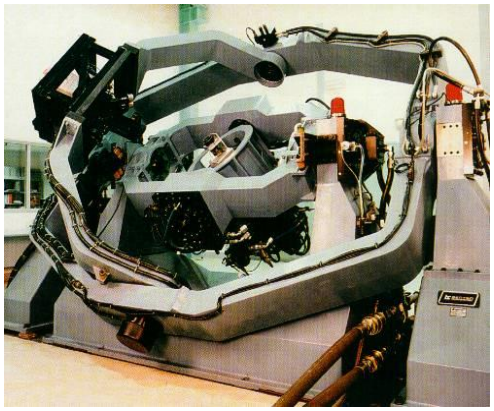
Weapons Analysis

- Seeker and autopilot characterisation
- Guidance performance evaluation
- Target and countermeasure response
- HWIL, captive-carry and live trials



Advanced Capabilities

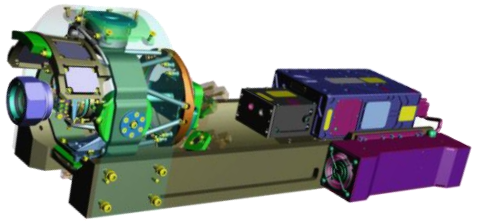
- Millimetre wave
- Ladar Seeker
- Autonomous navigation in GPS denied environments
- Adaptive control
- Seeker augmentation through hardware and software development



EO Sensors and Processing

Guided Systems Technologies and Evaluation

RF Sensors and Processing

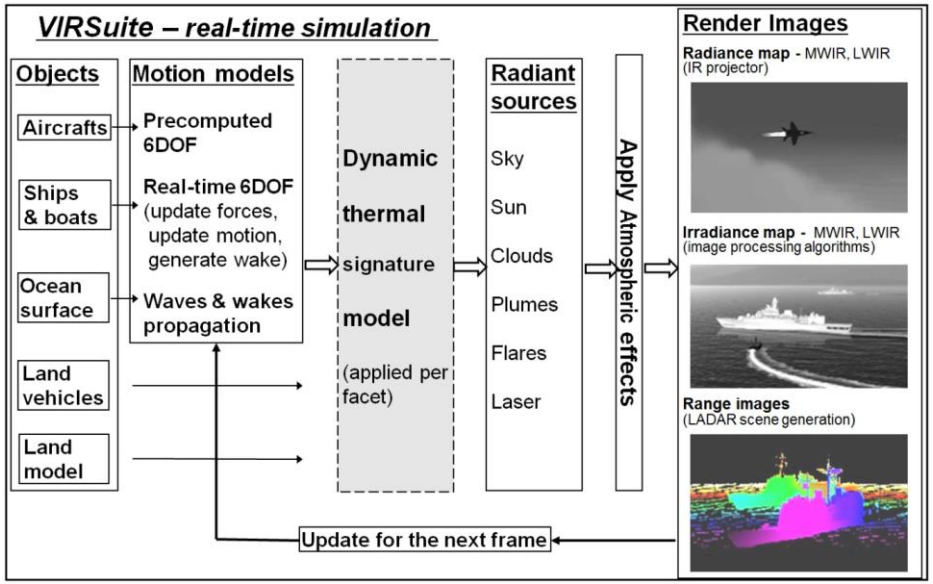


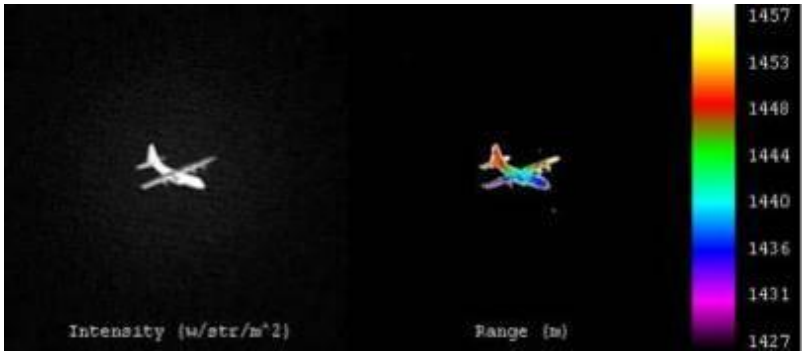
Performance Prediction

- Digital models based on system/subsystem analysis
- Real-time hardware-acceleration
- Accurate signal processing implementation

VIRSuite Simulation Capability

- Real-time physics-based
- Infra-red and visible imagery
  - aircraft, ships, land vehicles
  - terrain model
  - sky, sun clouds
  - plumes, flares
  - active radiant sources
  - atmospheric effects
  - sea properties
  - dynamic models



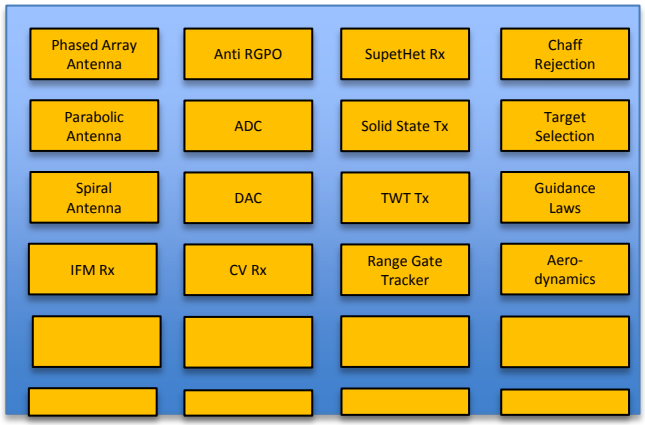


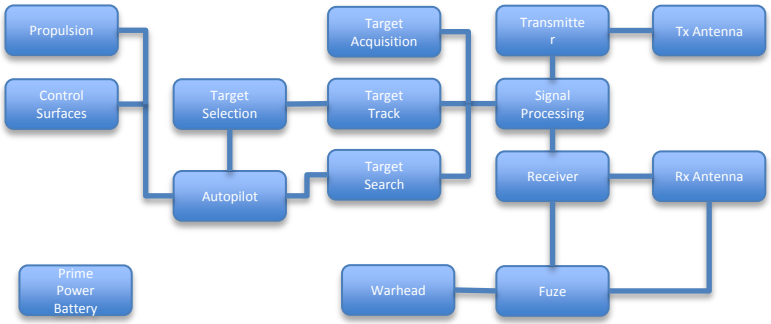
Applications
- Hardware in the loop systems
- Training simulators
- Trials reconstruction
- Tactical development

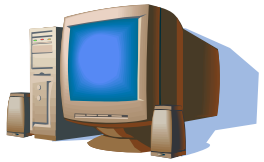
Partnership opportunities exist in further development of the VIRSuite capability and implementation in applications for ADF and Allies' use.

CHIMERA Weapons Emulation

- **Requirement – prediction of weapon performance in unspecified environments**
  - Targets - multiple with accurate dynamic signatures
  - Electronic Warfare – advanced jamming techniques
  - Clutter – dynamic in any environment
- Hardware accelerated real-time models
- Collaborative activity with US and UK government agencies and contractors







Re-usable Blocks → System/Subsystem Model → Hardware Integration

Partnership opportunities will exist in sub-system model development and implementation in hardware-in-the-loop digital models.

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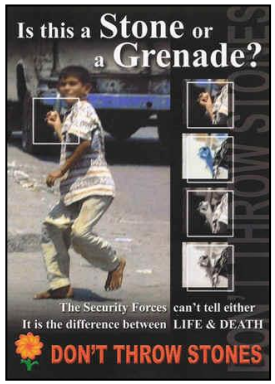
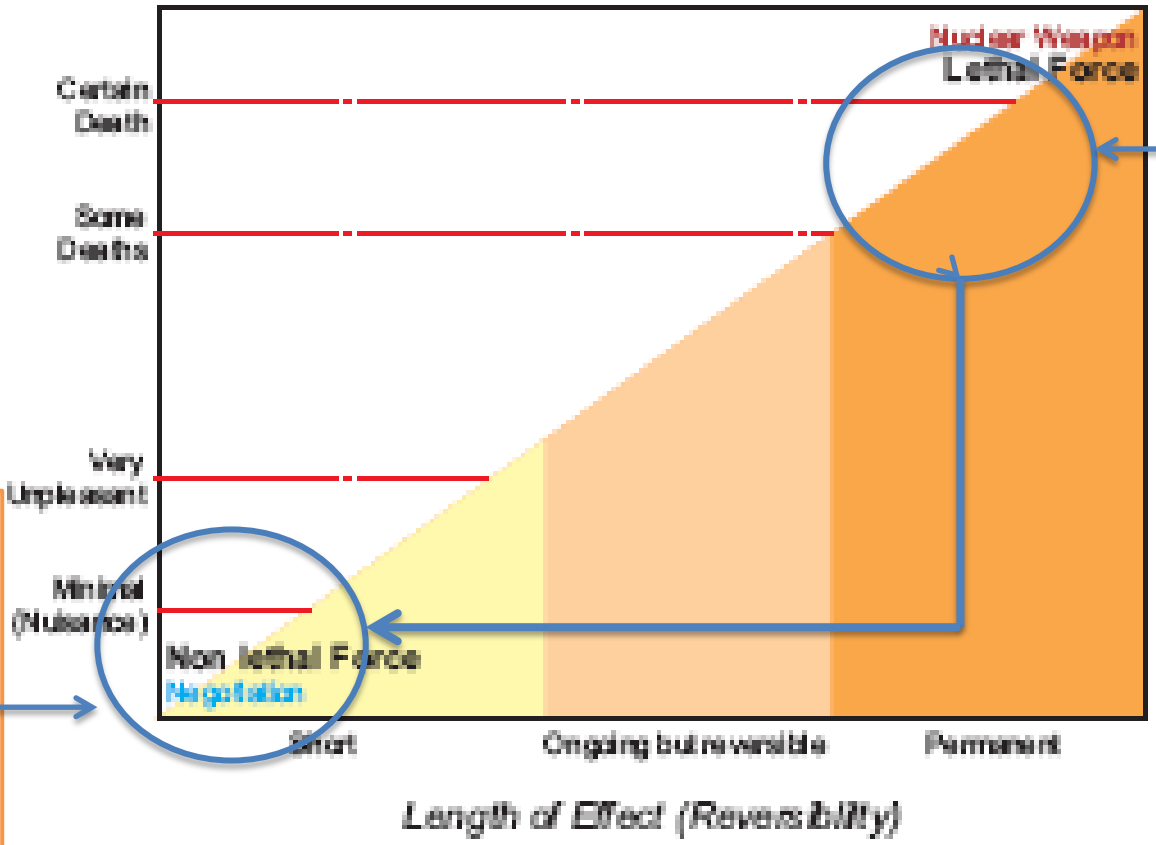
Graduated Force – An Opportunity

Land Weapons Systems Effects

Presented by: Mr Steve Forbes

Graduated Force in the context of the Modern Military- The Problem Space





Where we have traditionally operated.

- Training
- Capability
- Doctrine

Where we are increasingly being forced to operate.

- Problematic
- Constrained
- Little Capability
- Lack of training

Graduated Force - Working in the Problem Space – "Non Lethal" Force

- US DoD Definition - **Weapons, devices and munitions that are *explicitly designed* and primarily employed to incapacitate targeted personnel or materiel immediately, while *minimising fatalities*, permanent injury to personnel, and undesired damage to property in the target area or environment. Non-lethal weapons are *intended to have reversible effects* on personnel and materiel."**

No guarantees – its all about the intent!

Exemplar "Non lethal" Technology Options

OPTICAL

ACOUSTIC

CHEMICAL

ELECTRICAL

✓ *Today's Opportunity*

KINETIC

Combined i.e. Sound & Flash

Kinetic Energy Based Systems
Traditional and most widely employed

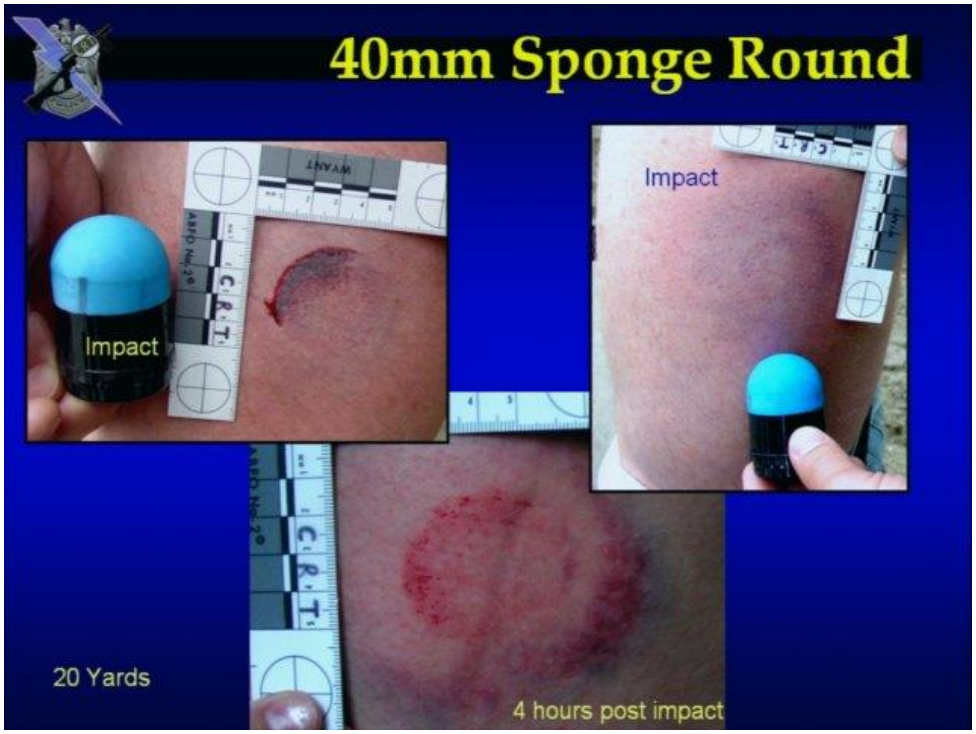
- Where we are now.
  - Current traditional Non Lethal capabilities based around ballistic weapon systems have performance limitations primarily because the NL projectile is fired with one fixed launch velocity from the weapon.
  - Therefore this limits the effectiveness and safety over the entire engagement ranges that may be encountered in operations i.e. at longer ranges ineffective – at short range increased danger.

Kinetic Energy Based Systems

Why adjusting the launch velocity can be critical.

Increasing kinetic energy = Increasing risk

✓ **Acceptable Injury – short time + reversible**



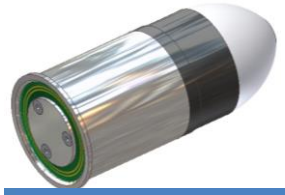
× **Unacceptable Injury - Long term serious consequences**

The Opportunity!

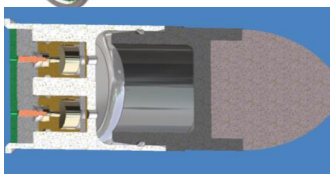
Managed Lethality Grenade Launcher System (MLGLS)

- DSTO has designed, developed and **patented** a novel "Non Lethal/Lethal" weapon concept known as the Managed Lethality Grenade Launcher System (MLGLS).

Weapon Platform



- The MLGLS has the unique capacity to fire 40mm NL projectiles, at **variable launch velocities**, by an integrated system based on a laser range finder, Fire Control Unit and Specialised Modular Cartridge with an impact attenuating projectile.



Modular Cartridge and Impact Attenuating Projectile

- In Non Lethal applications this allows the system to deliver the **optimal kinetic energy** to the target for each specific engagement range, hence achieving the best on target effects whilst also minimising the risk of injury to the target.

Fire Control Unit

Laser Range finder

- System components will fit to extant 40mm weapon systems without affecting their existing capabilities (hence capability adding).

Bottomline -current status

- Needs Industry Champion - Risk = $Reward

Current Status of the MLGLS

- The MLGLS is at prototype TRL 7, is patent pending and has been trialled both domestically and internationally with positive reviews.

North American Technology Demonstration- Joint Non Lethal Weapons Directorate and NATO

Commercial Opportunity for MLGLS

- The global market for non-lethal weapons is estimated at US$1.146B and growing as a compounded annual growth rate of 5.42% pa. The US, Europe and Asia are expected to spend an estimated $US4.3B between 2014-18 on non-lethal weaponry.

- **COME and SEE us at the Weapons and Combat Systems Division Stand.**

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Energetic Materials Partnering Opportunities

Energetic Materials and Systems

Presented by: Dr Gregory Freebairn

Energetic Materials & Systems Branch

Explosives and Pyrotechnics

Military Explosives and Explosive Ordnance

Pyrotechnics and Countermeasures

Home-Made Explosives – CIED and National Security

Weapons Propulsion

Gun and Rocket Propellants

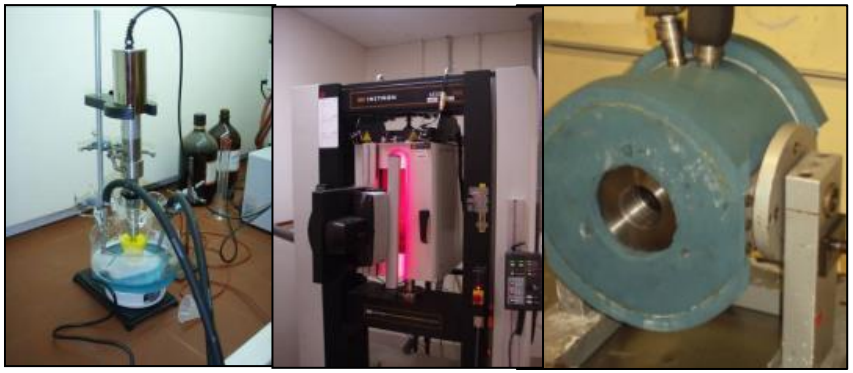
Missile and Gun Propulsion Systems

Propulsion System Safety and Sustainability

Propulsion System Test and Evaluation

Explosives Ordnance Management Team

Formulation Development and Synthesis

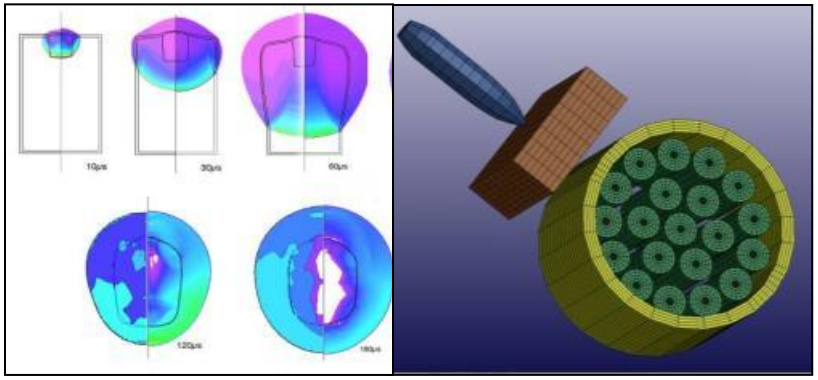


Analysis and Characterisation

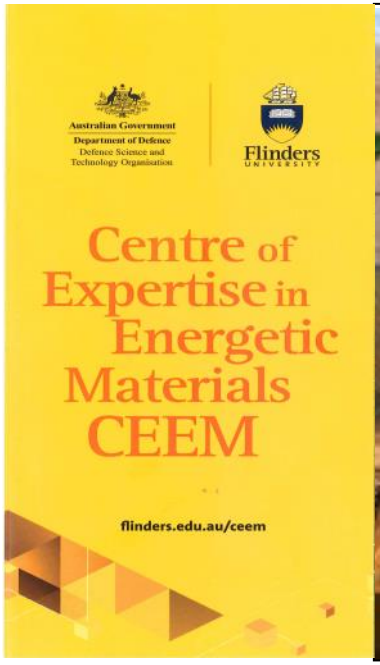
Unique National EO Facilities

Instrumentation, Testing and Evaluation

Modelling and Simulation

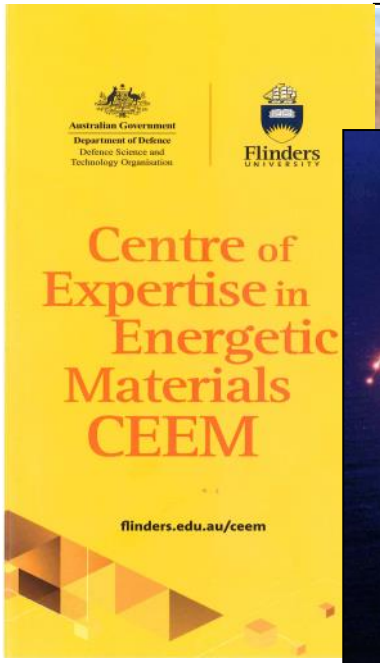


Partnership Opportunities



Centre for Expertise in Energetic Materials

Partnership Opportunities



Centre for E

IR Countermeasures

Partnership Opportunities

Centre for E

IR C

Gun Propulsion

Partnership Opportunities

Centre for E

IR C

G

Rocket Propulsion

Weapons and Combat Systems Division is OPEN for Business …

We would welcome opportunities to partner with you!

Please Contact

Wayne Power – WCSD External Engagement Manager

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wayne.power@dsto.defence.gov.au