Australian Government
Department of Defence
Defence Science and Technology Organisation

The Science foundation of evidence-based policy and decision making

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ASOR Seminar series

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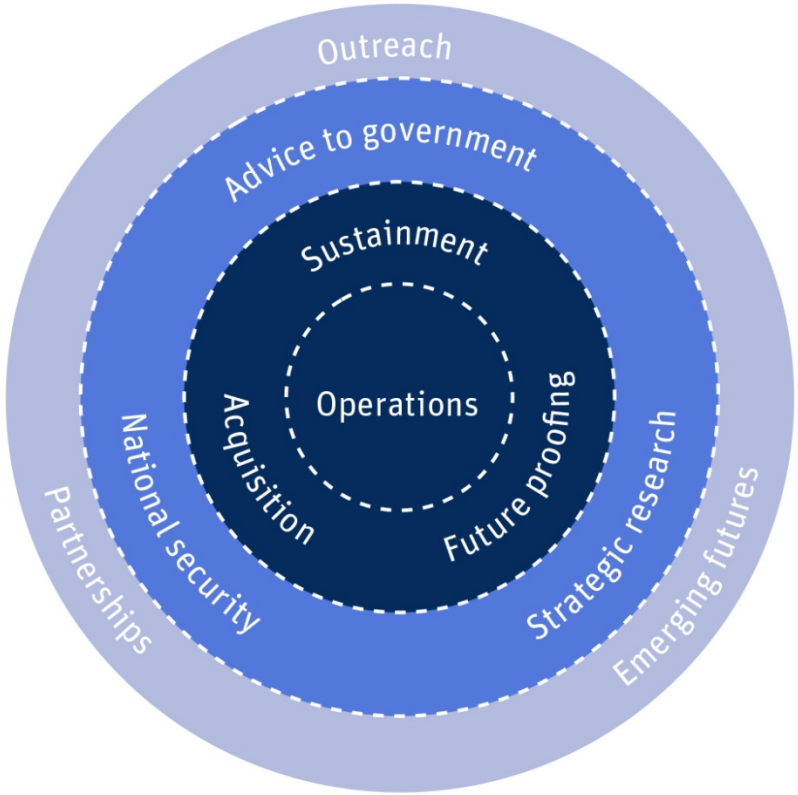
DSTO | Science and Technology for Safeguarding Australia

DSTO Purpose

DSTO is a national leader in safeguarding Australia by delivering valued scientific advice and innovative technology solutions for Defence and national security



DSTO ENABLERS

TECHNICAL SERVICES	SCIENCE AND TECHNOLOGY TRAINING AND DEVELOPMENT	BUSINESS SERVICES

Majority of program is providing evidence-based 'advice' across all our roles

APS200 project: The Place of Science in Policy Development in the Public Service*

"*Policy making within the APS needs to be based on a rigorous, evidence-based approach that routinely and systematically draws upon science as a key element*."

5 key challenges:

- **Timeliness** of scientific evidence is critical to its uptake in policy
- **Cultural** challenges can impede effective interaction between scientists and policy makers
- **Relationships** between scientists and policy makers is critical
- **Timeframes** associated with policy development can be challenging
- **Access** to and use of scientific data and research services to support policy

Still significant issues even for an embedded organisation like DSTO

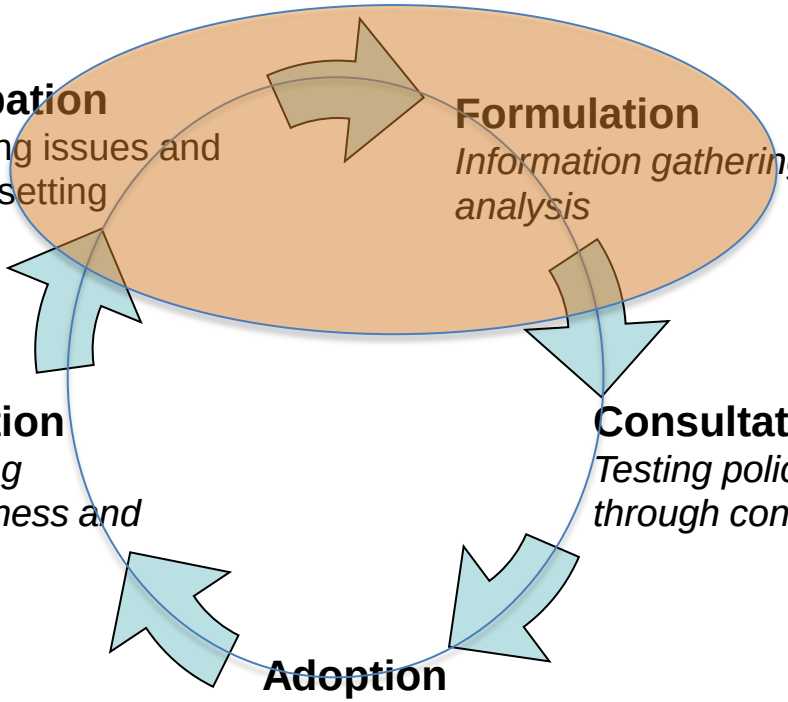
* Dept of Industry and Science, 2012

Australian Policy Cycle*

Early science-based input reduces risk and saves $

S&T push and pull

Critical scoping phase
Options analysis



Test strength of analysis

Metrics and analysis

Scrutiny and decision support/ Visualisation

* Dept of Industry and Science, 2012

Decision making

Decision = Judgement + Evidence

A balance, influenced by:

- Time
- Complexity
- Risk/Cost
- Culture
- Access to expertise

Establishing an evidence base takes leadership and resources

- "Establishing a robust, accessible evidence base to support decisions on infrastructure reforms and investments is also critical.
- Without this evidence base, it is difficult for our governments, the private sector, and the wider Australian community to have a clear understanding of where the major challenges lie."*

* p. 4

Where Judgement and Evidence collide….

THE AGE
Victoria

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NZ apples will burn us: orchardists

July 29, 2011

Adam Carey

1921 Importing NZ apples into Australia was banned (due to 'risk' of fire blight…)

2005 New Zealand challenged Australia's risk argument

2006 Australia formalised its risk assessment

2007 New Zealand lodged a formal dispute with the World Trade Org, contesting:

'*whether the science … was sufficient to support Australia's* [position]'

arguing that *'Australia has employed a flawed* [risk assessment]*… methodology…'*

2010 The WTO Panel upheld New Zealand's challenge:

"…the Panel … determined that [Australia's risk] *estimation … was not supported by adequate scientific evidence and, accordingly, was not coherent and objective."* *

2011 NZ apple imports into Australia commenced.

* World Trade Organisation, 2010, Report of the Appelate Body, AB-2010-2, https://www.wto.org/english/tratop_e/dispu_e/367abr_e.pdf

Australian Government
Department of Defence

First Principles Review

Creating One Defence

- Announced by Defence Minister on1 April.
- **Significant** reform across Defence.

Defence faces five strategic challenges

Science and technology implications

Significant capability modernisation

- The largest most technically ambitious and complex portfolio we have ever delivered
- Creates the imperative to improve the efficiency and effectiveness of capability decisions

Rapid technological change

- Increases the cost and risks of delay in the capability portfolio
- Creates opportunities to gain advantage or cost efficiencies by leveraging technology

Budgetary uncertainty

- Increases the need for transparency and sound financial stewardship
- Means Defence must demonstrate value for money to the government and wider community

Economic growth in our region

- Driving rapid regional military modernisation
- Creates an uncertain strategic environment and increases the need for sound policy advice

Greater demand for military responses to various regional and expeditionary crises

- Requires a greater emphasis on joint capabilities
- Increases the need to deliver high quality policy advice and work effectively across government

Defence faces five strategic challenges

Strong drive for evidence-based decisions

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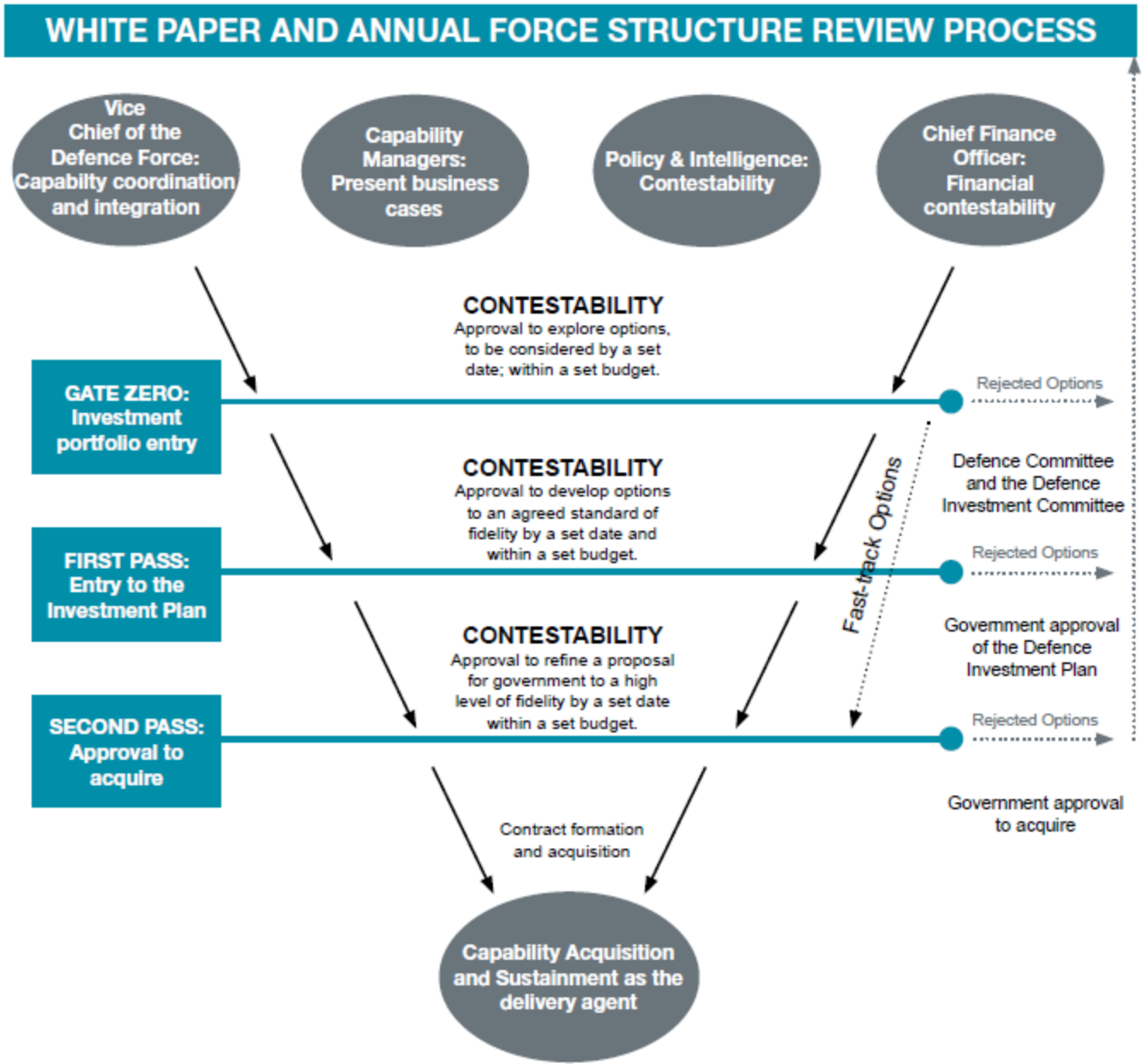
New process to enhance contestability/scrutiny

Capability Acquisition and Sustainment Group will be project manager



Capability Manager will be the sponsor throughout the capability life cycle

Defence Projects Are Complex

Airborne Early Warning & Control

Complex innovative technology

Air Warfare Destroyer

Complex system integration

Future Submarine

Complex gov't to gov't relationships

SATCOM

Multiple stakeholders & governments

Joint Strike Fighter F-35A

Multiple stakeholders and governments

Complex innovative technology

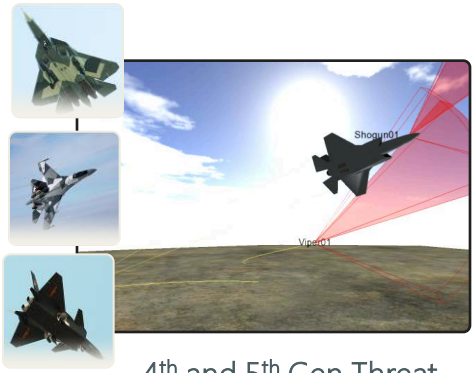
Complex system integration

Support to Operations

- Hand-Held Detector Study increased the protection for Australian troops
- Cultural compatibility study informed ADF mentoring mission
  - Incorporated into NATO guidance

Policy question: how to reduce risk to life?

Operational Analysis Supporting Joint Strike Fighter - 'smart buyer'



4th and 5th Gen Threat Assessment
+
Concept of Operation/Tactics Evaluation

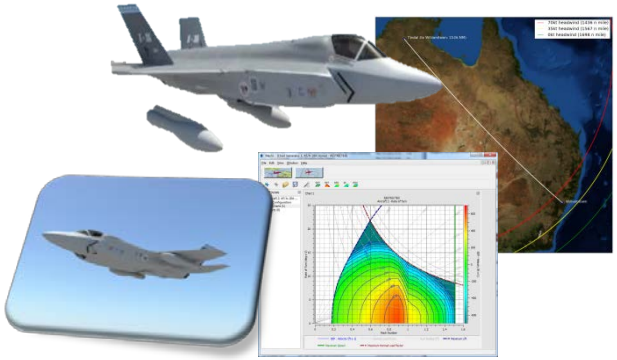
Policy question: how to reduce risks to delivery of capability?

F-35A Interoperability

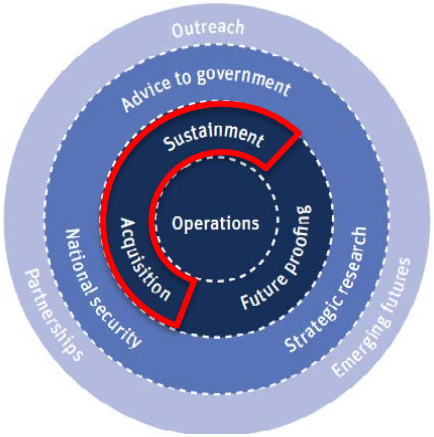
Beyond Line of Sight Communications

Radar & Electonic Attack Modelling

External Fuel Tank Assessments

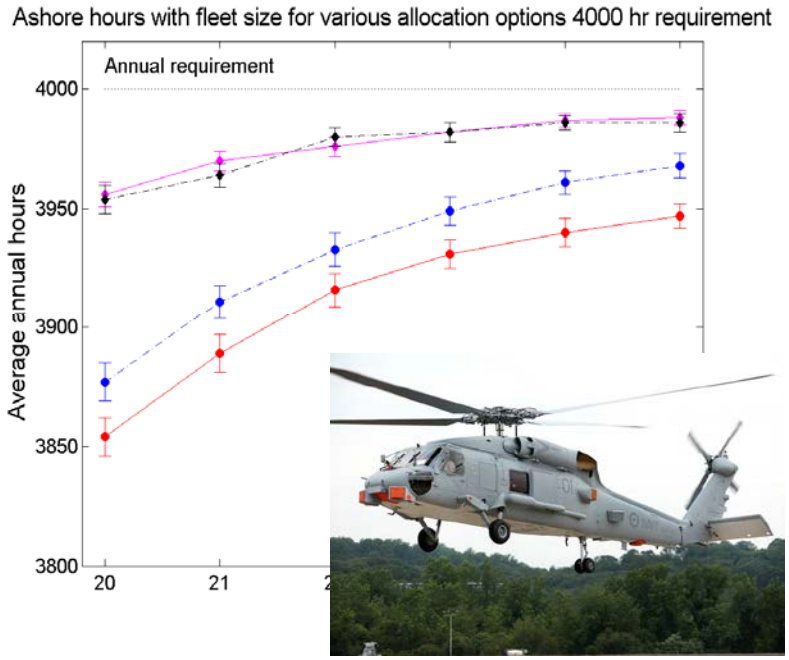


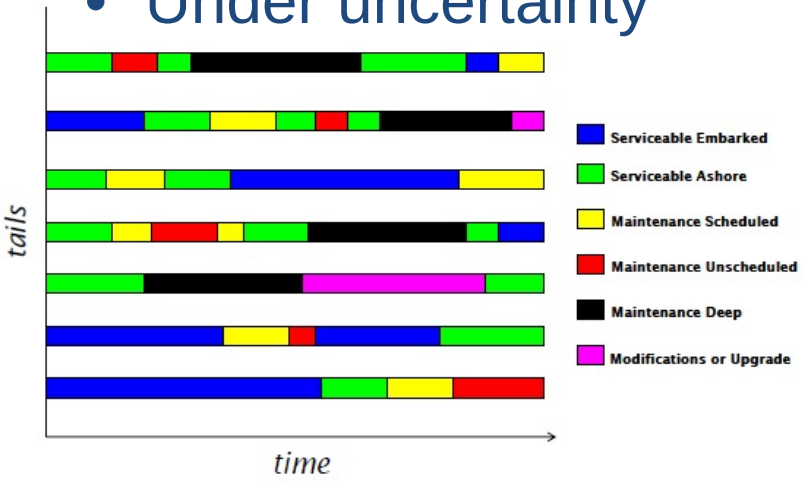
Operational Analysis: Navy Combat Helicopter fleet - 'smart buyer'



- Discrete event simulation
- Model per day/30 years
- For different fleet size options
- Direct translation into on-going fleet management sustainment
  - Under uncertainty

Policy question: how many do we need?





Each Helicopter in one of 6 states

Fleet size options to meet 4000 hours requirement. Answer = 4 2

Sustainment – evolving capability and reducing costs

RAN Polyurethane paint not suited to Australian conditions:

- Storm Grey is wrong colour
- Paint not durable enough

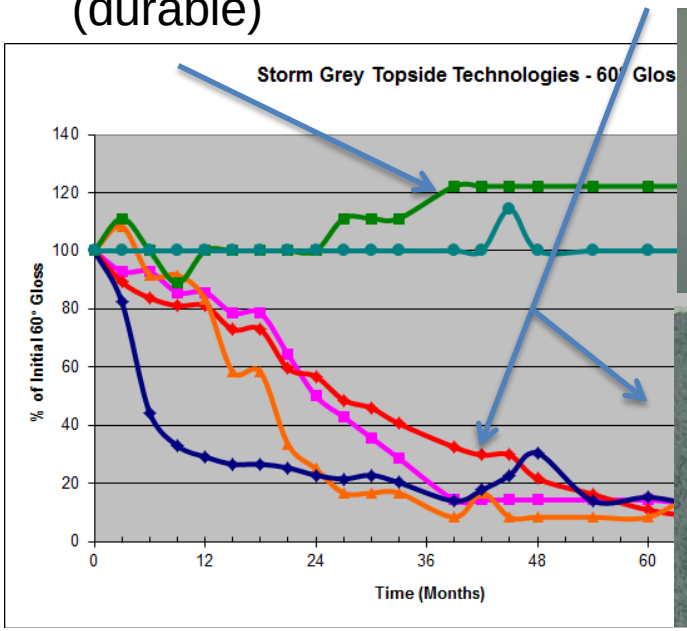
Investigated other options:

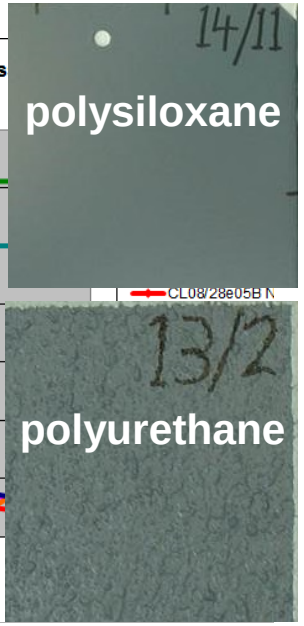
- Haze Grey is more suitable for northern Australian waters
- Polysiloxane paint chemistry
  - More durable
  - More colour-stable
  - Less toxic (isocyanate-free)
  - Reduced environmental pollution
  - Low Solar Absorbing - Reduced thermal signature
- Overall – higher quality, at same or reduced cost.

Policy question: how to maintain capability at least cost?

polysiloxane paint (durable)

polyurethane paint (degrades)





Futures

- *Forward 2035* –DSTO foresighting study
- Key trends identified
  - Trust in Technology
  - Mastering Complexity
  - Smart Power
  - Innovation Enterprise
- *Forward 2035* informing the White Paper and future Force concepts

Policy question: What future issues do we need to plan for?

Science foundation is broad!

Deputy CDS groups
Responsible for corporate duties in order to shape strategic direction and enhance engagement with Defence and external partners.

DCDS Strategy & Program
Develops science policy, formulates client and strategic research programs, and oversees resource investment into S&T capabilities.

DCDS Partnerships & Outreach
Coordinates and develops interactions with industry, academia, overseas agencies and other Australian government agencies. Promotes defence science in the education and wider Australian communities.

DCDS Corporate Delivers enabling services including science information management and technology, research infrastructure, scientific engineering and support, laboratory emergency management, safety and security.

Maritime Division (MD)
Provides support and solutions to enhance the operational performance and survivability of defence platforms in the maritime domain.

Sonar Technology and Systems Undertakes research, development, test, evaluation and prototyping of undersea acoustic sensors, systems and concepts to counter undersea threats.

Signature Management
These two MSTCs conduct research into **1. Acoustic and 2. Non-acoustic** (radar, infrared and visible) signature treatment and control.

Maritime Autonomy
Leads the development of systems operating independently in complex environments, and intelligent sensor payloads.

Undersea Command and Control
Enhances ADF undersea warfare effectiveness.

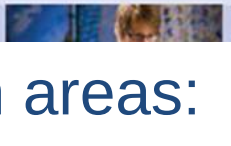
Naval Architecture Enhances the capability requirements definition, performance, safety and through-life management of ship and submarine structures and propulsion systems.

Platform Survivability
Enhances defence platform survivability through vulnerability and recoverability analysis.

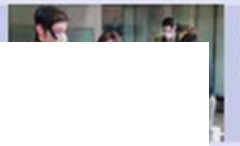
Land Division (LD)
Provides support and solutions for ADF personnel by applying expertise in human sciences, vehicle and systems sciences, and chemical and biological warfare.

Land Human Systems
Develops, sustains and applies the broad cross-section science skills in support land operations.

Land Vehicles & Systems
Applies vehicle and systems



Chemical & Biological Defence
Research and development



Land Personnel & Protection
Supports soldier combat system development, and analysis of threats affecting the soldier.

Aerospace Division (AD)
Provides support and solutions to enhance the operational effectiveness, performance, survivability, availability and safety of ADF aerospace capabilities.

Aerospace Systems Eff
Supports Defence outco capability, efficiency an by providing advice and where humans and air p or systems interact.

Applied Hypersonics
Supports technology for propulsion used in air vehicles traveling at speeds in excess of Mach 5.

Joint and Operations Analysis Division (JOAD)
Analyses Defence operations and capability to provide independent, impartial and timely advice.

Three JOAD MSTCs deve and tools to inform deci **2. Land Capability and** specification, procurem technologies, force stru operational effectiveness

National Security Intelligence Surveillance & Reconnaissance Division (NSID) Enhances the national capability for accurate, relevant and timely actionable intelligence for Defence and Government decision makers.

Intelligence Analytics
situational awareness c for intelligence analysts conducts domain-specif into human, open-sourc source analysis techniq

National Security
Provides a whole-of-government coordination program for science and technology needs relating to national security.

Cyber and Electronic Warfare Division (CEWD)
Provides expert advice and technology solutions in the cyber domain and electronic warfare environment.

Cyber Assurance and O
Supports enhanced perf in the presence of threa unauthorised activities computer resources.

EW Operations
Provides countermeasures for detecting and defeating threats using the electromagnetic spectrum.

Weapons and Combat Systems Division (WCSD)
Applies science and technology to the development and operation of highly effective weapons systems for Defence.

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

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
Assesses individual weapon system performance and end-to-end combat system effectiveness.

Land Weapons Systems and Effects
Supports all aspects of ADF unguided weapons.

Energetic Materials and Systems
Research into the delivery of appropriate destructive energy to targets.

OA growth areas:

- (Big) data analytics
- Super/cloud computing
- (Interactive) Visualisation
- Behavioural representation
- Robust analysis/optimisation under uncertainty

Strategic alliances with industry

Partnerships for delivering new and improved capabilities for Defence and National Security

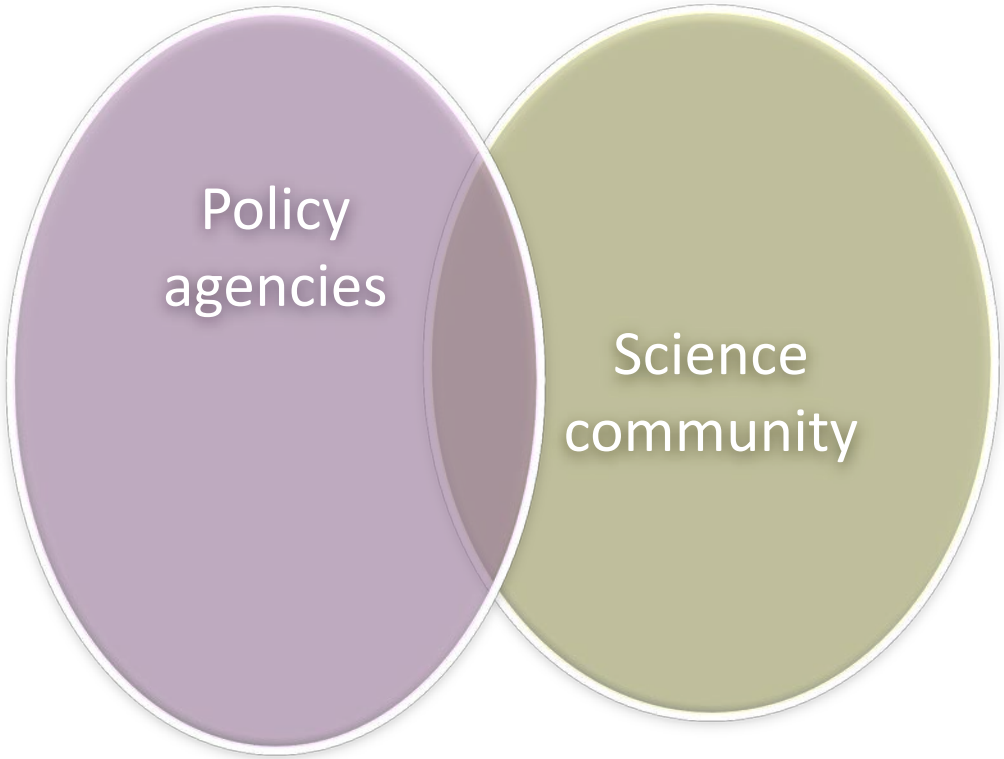
Strategic alliances with universities

Defence Science Partnership

- New partnerships with universities
- Streamlined business model
- Twenty-one Australian universities signed up

Conclusions

- Better engagement
  - Within policy agencies
  - Within science community
  - Between policy and science communities
- Build capacity through collaboration
  - ASOR is one mechanism
- Leads to fit for purpose analysis



Closer linkages?

Thank you and Questions

www.dsto.defence.gov.au

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