

Science and Technology Capability Portfolio



Science and Technology for Safeguarding Australia



Science and Technology Capability Portfolio



Glossary

AAMOST	Anglo Australian Memorandum on Science and Technology	EM	Electro-magnetic	OPCW	Organisation for the Prohibition of Chemical Weapons
AAS	Australian Academy of Science	FGAN	Research Institute for Applied Sciences (Germany)	ONR	Office of Naval Research (US)
ABCANZ	America, Britain, Canada, Australia, New Zealand	FPDA	Five Power Defence Arrangements (UK, Australia, NZ,	RAeS	Royal Aeronautical Society
	information exchange MOU		Singapore, Malaysia)	RINA	Royal Institution of Naval Architects
ADF	Australian Defence Force	ICSSP	International Conference on Sport Psychology and Performance	R&D	Research & Development
ADFA	Australian Defence Force Academy	1555		RMIT	Royal Melbourne Institute of Technology
AFP	Australian Federal Police	IEEE	Institute of Electrical and Electronics Engineers	SIGINT	Signals Intelligence
AFRL	US Air Force Research Laboratory	IIE	Institute of International Education	SPAWAR	US Navy Space and Naval Warfare Systems Command
AFSEO	US Air Force SEEK EAGLE Office	INCOSE	International Council on Systems Engineering	SPIE	International Society for Optics and Photonics
AISC	Australian Industry Skills Committee	MORS	Military Operations Research Society	T&E	Test & Evaluation
AOSM	Australian Operational Service Medal	MOU	Memorandum of Understanding	TTCP	The Technical Cooperation Program, within which are the
ANSTO	Australian Nuclear Science and Technology Organisation	MSSANZ	Modelling and Simulation Society of Australia & New Zealand	TICE	following 10 Groups
ANZPAA	Australia New Zealand Policing Advisory Group	NATO	North Atlantic Treaty Organisation		AER Aerospace Systems Group
ARDEC	US Army Armament Research, Development and Engineering Centre	NATO STO	O NATO Science and Technology Organisation, within which there are the following panels;		C3I Command, Control, Communications and Information Systems Group
ASC	Australian Submarine Corporation		AVT Applied Vehicle Technology		EWS Electronic Warfare Group
ASD	Australian Signals Directorate		HFM Human Factors and Medicine		HUM Human Resources and Performance Group
AUMICE	Australia and the United Kingdom Memorandum of		IST Information Systems Technology		ISTAR Intelligence, Surveillance, Target Acquisition and
	Understanding on Military Capability Harmonisation and Equipment Cooperation		SAS Systems Analysis and Studies		Reconnaissance Group
ВоМ			SCI Systems Concepts and Integration		JSA Joint Systems and Analysis Group
	Bureau of Meteorology		SET Sensors and Electronics Technology		LND Land Systems Group
CBRN	Chemical, Biological, Radiological, Nuclear	Plus the:			MAR Maritime Systems Group
CRC	Cooperative Research Centre		MSG NATO Modelling and Simulation Group		MAT Materials and Processing Technology Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation		CMRE Centre for Maritime Research and Experimentation		WPN Conventional Weapons Technology Group
CTTSO	Combating Terrorism Technical Support Office (US)	NAVAIR	Naval Air Systems Command (USN)	ugv	Unmanned Ground Vehicle
CUESC	Contested Urban Environment Strategic Challenge	NSRDEC	U.S. Army Natick Soldier Research, Development and	US DHS	United States Department of Homeland Security
CWALN	The Chemical Warfare Agent Laboratory Network		Engineering Center		
DMTC	Defence Materials Technology Centre	NSWS	Naval Surface Warfare Centre (USN)		

Naval Undersea Warfare Centre (USN)



NUWC

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Message from the Chief Defence Scientist



Excellence in science and technology is fundamental to an agile, innovative, capable and modern Australian Defence Force. For this purpose Defence maintains a strong portfolio of science and technology capabilities across a wide spectrum of military domains and operations.

This publication captures Defence's Major Science and Technology Capabilities which should serve as a valuable resource for our partners and external stakeholders.

Our Major Science and Technology Capabilities are independently reviewed by international experts and many of them have been rated as world benchmarks.

Achieving and maintaining excellence in science underpins the quality of the independent advice that we provide to Government. Defence values science excellence for its contribution to saving lives, enhancing effectiveness, reducing and mitigating strategic and operational risks and maintaining a capability edge.

Partnerships with industry, academia and government agencies, national and international, are essential to strengthen and supplement Defence's capability and technology base.

We trust that you can make good use of the information in this publication.

We also hope that this will inspire industry and academia to continue contributing to the growth of Defence capabilities for the future.

Dr Alex Zelinsky

Chief Defence Scientist





Introduction

Science and Technology (S&T) play a critical role in safeguarding Australia's defence and national security.

Defence Science and Technology Group (DST) has been supporting the Australian Defence Force for more than 100 years with innovative technology solutions that deliver a capability edge.

Today, Defence Science and Technology is managed in terms of Major Science and Technology Capabilities

A **Major Science and Technology Capability (MSTC)** consists of people with S&T knowledge, infrastructure, and partner relationships within an area of science and a defence domain. This document provides a snapshot of Defence's MSTCs. It is a summary of how an MSTC, working with its partners, has delivered outcomes for Defence together with examples of how **DST** measures its science and technology excellence.

The scientists, engineers and technical specialists working in the 37 MSTCs described in this document are supported by the skills of staff in the three corporate divisions who deliver the science policy and strategy, the frameworks for science partnerships and external engagement, associated enabling research services such as computing, safety and security as well as staff from areas such as finance and human services which are shared across the rest of Defence.

DST's distinctive value is derived from the combination of its unique world-class sovereign capabilities, its deep knowledge and responsiveness to the Australian defence environment, its active collaboration with the best partners nationally and internationally and its ability to combine these to deliver soundly based independent advice.

DST has several roles, of which one is to ensure that Defence can both prevent and create strategic surprise as a result of the application of innovative technologies. In order to achieve this **DST** aims to continue to build and foster a national science and technology base. A second aim in delivering this role successfully is to generate and transfer technology into ADF capability through collaboration with industry.

The contents of this document are intended to help build an understanding of **DST's** science and technology skill base as a starting point to further our external engagement.





Science and Technology: Purpose and Roles in Defence



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







Maritime Division

Science and Technology for Safeguarding Australia

Sonar Technology and Systems

Goal

Develop and apply sovereign undersea acoustic sensing, processing and analysis expertise to provide the current and future ADF with an acoustic undersea warfare capability edge.

Impact

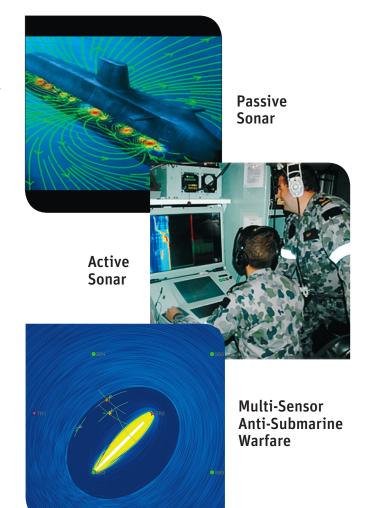
Sovereign USW S&T Capability: Targeted industry and academia partnerships in critical undersea warfare technologies to ensure ADF maintains its capability edge against current and future undersea threats.

Next-generation sensor technologies: Our patented fibreoptic technology turns a single optical fibre into 32 hydrophones. Industry is using this technology in prototype towed and seabed acoustic sensor systems.

Collins and Future Submarine Sonar: Pivotal advice and design partner for enduring regional undersea acoustic superiority.

Airborne ASW: National & international collaborative R&D program focused on future wide-area, airborne ASW capability for theatre and task group scale ASW.

Sonar Processing and Visualization: Our technology has been transitioned via Australian Industry to improve operational sonars on RAN ships and submarines.



S&T Excellence

Three year publication record

8 DST Technical Reports

11 DST Client Reports

7 Journal Publications

41 Conference Papers

1 Patent

Peer Recognition

- Adjunct Positions: UWA, Curtin University
- PhD Supervision: UWA, Curtin University
- National Lead TTCP MAR TP9

Awards

- TTCP Achievement Awards 2014, 2016
- Clunies Ross Awards 2015
- DST Group Awards 2012, 2013, 2015 (multiple)
- Australian Acoustical Society WA Tertiary Prizes 2014 & 2015

PARTNERSHIPS & OUTREACH

Universities

Sydney University RMIT University Adelaide University Flinders University University of WA (UWA) Curtin University

Industry Thales (Aus) Ultra Raytheon Sonartech Atlas L-3 Oceania

In-Situ Pacific

Boeing

Government

CSIRO Bureau of Meteorology

International

TTCP MAR Group NATO/CMRE USN ONR, NUWC, NAVAIR DTA (NZ) Thales UK and France Dstl (UK) University of Washington



Acoustic Signature Management

Goal

To control and manage the acoustic signature of RAN platforms providing increased operational effectiveness and improved survivability.

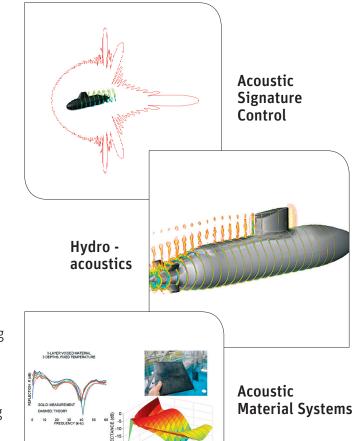
Impact

Anechoic Tiles: New anechoic tiles have been developed to reduce submarine susceptibility to detection by active sonar threats, increasing the survivability and operational effectiveness of the platforms.

Acoustic Signature Monitoring: Partnering with industry a command decision aid has been developed to provide "realtime" signature and susceptibility estimates providing greater situational awareness to the command team.

Platform Acquisition: The provision of S&T advice on acoustic signatures and signature reduction to the new surface platform and submarine acquisition projects ensuring the new capabilities have regional superiority.

Submarine Training: The development of new maneuvering and control models for the training simulator at Fleet Base West, improving the fidelity of operator training and reducing the onboard training requirement for new operators.



S&T Excellence

Three year publication record

52 DST Technical Reports

79 DST Client Reports

38 Journal Publications

76 Conference Papers

Peer Recognition

- · 4 ARC Grant Reviewers
- · Adjunct Professors: UNSW, QUT, Australian Maritime College
- PhD Supervisor: UNSW, QUT, UQ
- National Lead TTCP MAR Group TP4

Awards

- · Minister's Award for Defence Science 2014 (S Burke)
- Defence Commendation 2012
- SA Engineering Excellence Award 2013
- DST Group Awards: Outstanding Contribution to Collaborative Partnerships 2013, Outstanding Communication of S&T 2014. Science and Engineering Excellence 2016.
- Best Papers: AAS 2012, 2015 IEEE 2012; IIE 2015; AE 2014; MSSANZ 2011: RINA 2016

PARTNERSHIPS & OUTREACH

Universities

University of Melbourne University of Tasmania **University of Adelaide** Queensland University of Technology (QUT) University of WA University of NSW (UNSW) **RMIT University**

Industry

Frazer Nash **Mackay Industries** ASC OinetiO

Government **CSIRO**

TTCP MAR Group



International



Non Acoustic Signature Management

Goal

To enhance the survivability and operational warfighting capability and to reduce the cost of ownership of ADF platforms through the use of materials science and technology.

Impact

Platform Survivability: Partnering with industry to design. manufacture and install radar absorbing material on ships, submarines and aircraft to reduce the RCS of platforms to radar detection.

Safety: Leading the evaluation of chromate free primers for aircraft, including F35, and new isocyanate free navy topcoat has led to a safer workplace for platform sustainment.

Operational Capability: Design and application of Radar Absorbing Materials to the "surfboard" on 4 FFH's to significantly improve communication performance.

Platform Acquisition: The provision of S&T advice on signatures and management technologies for SEA 1000, SEA 5000, LAND 400, LAND 121, AIR 6000 ensures enhanced survivability and regional superiority.

Cost of Ownership: New anti-foul and durable coatings on ship hull, superstructure and propellers has reduced RAN fuel consumption, in water cleaning and maintenance costs.



Systems

Corrosion Sciences

S&T Excellence

Three year publication record

52 DST Technical Reports

39 DST Client Reports

24 Journal Publications

61 Conference Papers

Peer Recognition

- · 2 ARC reviewers
- TTCP MAT Group National Lead
- · Editor J. Computer Networks
- ONR Coatings Program reviewer

Awards

- Minister's Award for Defence Science 2013 (A Amiet)
- NATO STO Excellence award 2014
- Surface Coatings Association of Australia Lou Cash Memorial award 2016
- · Engineers Australia Excellence Award for Innovative R&D 2016
- DST Group Awards: Outstanding early career achievement 2014, 2016, Outstanding contribution to defence 2015. Technical Excellence Award 2014. 2016
- CDS Gold Level Commendation 2011
- CN Silver level Commendation 2012
- TTCP MAT Group Personal Achievement

PARTNERSHIPS & OUTREACH

Universities

Swinburne University of Technology **Deakin University** University of Wollongong La Trobe University University of South Australia **RMIT University** University of Melbourne Flinders University

Industry

Mackay Industries BAE Systems PPG. Akzo Nobel. Iotun. DEFT. Protec. Axalta. RUAG MacTaggart Scott **Dow Chemicals**

Government

National Marine Science Committee NT & WA Departments of Fisheries **Australian Institute of Marine Science**

International

TTCP MAT, AER and MAR Groups **NATO SET Panel** NRL, ARL (US) Dstl (UK) TNO, MARI, Phillips Lighting (NL) WTD 52 (Germany) Atlas Elektroniks (UK) Lockheed Martin (US)



Maritime Autonomy

Goal

To enhance the ADF's maritime capability edge with smart sensors and unmanned systems for undersea warfare and littoral operations.

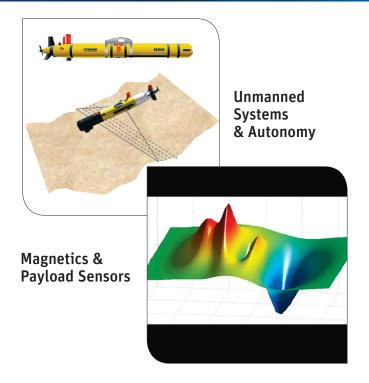
Impact

Sovereign Mine Warfare Capability: Unique scientific and technical knowledge of sea mine threats and platform signatures to help ensure safe passage in contested waters.

Concepts for unmanned undersea operations: Focused industry and academic partnerships that enable the ADF to explore and evaluate new paradigms in off-board mine countermeasure technology – to "take the man out of the mine field".

Persistent Surveillance: Exploiting unique Australian industry and academic skills to significantly augment current ADF ocean surveillance capability.

Advanced Autonomy: Exploiting advances in machine intelligence to demonstrate distributed, automated decision making in undersea warfare.



S&T Excellence

Three year publication record

21 DST Technical Reports

28 DST Client Reports

12 Journal Publications

11 Conference Papers

Peer Recognition

- Adjunct Professor Sydney University
- Adjunct professor UNSW
- TTCP MAR TP13 National Leader

Awards

- Minister's Award for Defence Science 2016 (B Ferguson)
- Minister's Award for Defence Science 2012 (D Cato)
- TTCP Awards 2014, 2016

PARTNERSHIPS & OUTREACH

Universities

Australian Maritime College Curtin University Queensland University of Technology University of Technology Sydney Sydney University University of NSW (UNSW)

Industry

AADI Boeing InSitu Pacific Kraken Systems Ocius, Ron Allum SAAB SfS Thales

Government

CSIRO Bureau of Meteorology

International

DSTA (Singapore)

TTCP MAR Group
USN ONR & NRL
US Army
Rochester Institute of Technology (US)
MIT (US)
Atlas Elektronik UK
ADD (Korea)



Undersea Command and Control

Goal

To improve the RAN undersea warfare effectiveness through improving the collection, processing and exploitation of undersea tactical information by undersea platforms and systems.

Impact

Joint Development: Improved the performance of the MK 48 Heavy Weight Torpedo and the AN/BYG-1 Combat Management system by the insertion of Australian algorithms.

Collins Class Submarines: Improved weapon control displays, periscope photography practice and operator training to increase submarine effectiveness.

Torpedo Countermeasures: Developed and delivered improved signal libraries for RAN torpedo countermeasures.

Human Systems Integration: Provided HSI technical leadership for SEA1000 – Endurance, Control Room & Habitability & Anthropometry

Optronics Research: Increased understanding of detectability and performance of optronic systems through collaborative PA and experimentation with the USA.

Signature & Stealth: Environment and sensor modelling to inform signature and stealth requirements for SEA1000.



S&T Excellence

Three year publication record

3 DST Technical Reports

31 DST Client Reports

20 Journal Articles

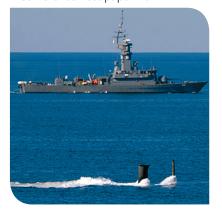
17 Conference Papers

Peer Recognition

- 2 adjunct positions; Curtin University and University of Adelaide
- 1 PhD examiner, 3 PhD Co-Supervisors

Awards

- USN NAVSEA Excellence Award 2014
- US Enterprise Integration Award 2015
- Curtin University Award 2016
- DST Group Award finalist 2014
- Human Factors & Ergonomics Society Conference Best paper 2014



PARTNERSHIPS & OUTREACH

Universities

Australian Maritime College
University of Melbourne
RMIT University
University of Adelaide
University of South Australia
Curtin University
University of Western Australia
Edith Cowan University

Industry

BAE Systems Lockheed Martin Raytheon Thales Ultra Atlas Elektronik UK

Government

CSIRO Bureau of Meteorology

International

and Warfare Assessment

TTCP HUM and MAR Groups
USN NUWC, NSWC, NAVSEA, PEOSUBS, ONR and SPAWAR
DSTA (Singapore)
DRDC (CA)
Dstl (UK)



Maritime Platform Performance

Goal

To ensure the Royal Australian Navy have surface ships and submarines that are safe, efficient, sustainable and survivable for their desired operational envelope.

Impact

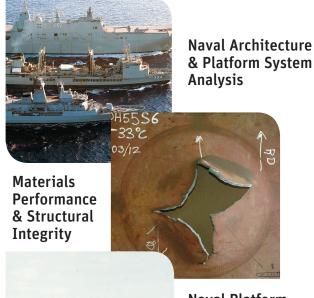
Sustainment: Partnering closely with Defence and industry has led to a substantial improvement in the structural integrity of the Armadale Class Patrol Boats.

Safety: Leading the technical investigation into the fire onboard HMAS Bundaberg has lead to improvements in fire protection for the Armidale Class Patrol Boat fleet.

Platform Acquisition: The development of performance and requirements analysis has shaped future acquisition projects such as SEA1000, SEA1180 and SEA3033 programs.

Reducing cost of ownership: Improvements in understanding the life of type issues for submarine hull valves has resulted in significant savings in maintenance costs.

Sustainment: Mechanical and Electrical failure investigations for return to service of RAN submarines and surface ships.



Power & Energy Systems

Dynamic Military

Loads





S&T Excellence

Three year publication record

69 DST Technical Reports118 DST Client Reports27 Journal Publications73 Conference Papers2 Book chapters

Peer Recognition

- Adjunct Professor and 2 senior lecturer positions at University of Tasmania – Australian Maritime College & Monash University.
- Advisory board members for University of Tasmania & Victoria University
- TTCP MAR Group National Lead

Awards

- Public Service Medal 2016 (Z Mathys)
- Fellow of the Academy of Technological Science and Engineering, 2016
- TTCP Award 2015
- 14 DST Awards over the last 5 years

PARTNERSHIPS & OUTREACH

Universities

University of Tasmania - Australian Maritime College University of Wollongong Flinders University Monash University University of Melbourne Queensland University of Technology

Industry

ASC DMTC Babcock Siemens Austal

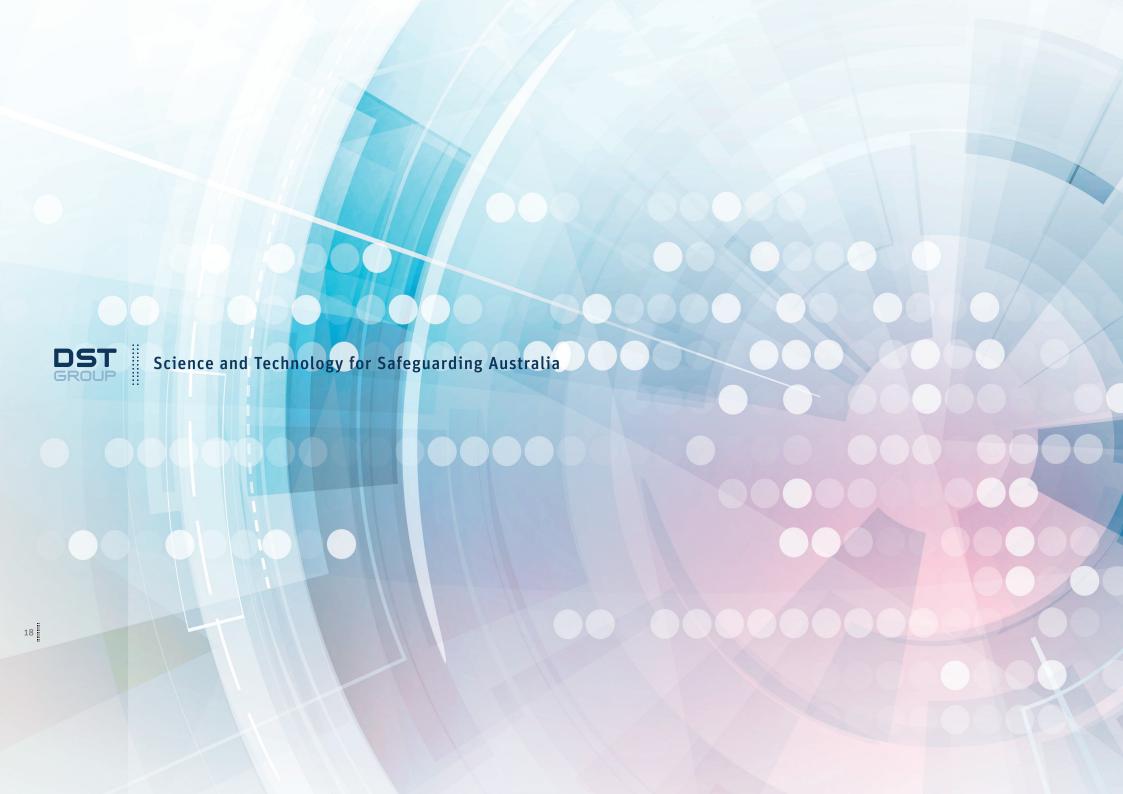
Government

ANSTO Customs AFP

International

TTCP MAR and MAT Groups Cooperative Research Navies Dstl (UK) ARL, ONR, NSWC (US) ABCANZ MARIN (NL)







Land Division



Science and Technology for Safeguarding Australia

Land Human Systems

Goal

To enhance the warfighter and the human systems that select, prepare, equip, protect and sustain them to prevail in their mission and reset for the next.

Impact

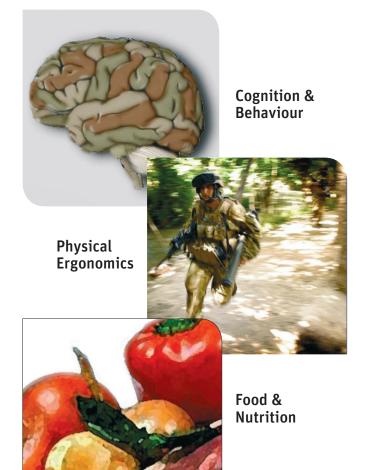
Cognitively Prepared: Research to meaningfully measure and practically enhance the selection and training of warfighters to cognitively outperform and resiliently outlast their adversaries.

Physically Prepared: Research building on the MSTCs design and delivery of the world leading physical employment standards for all ADF trades to effectively select and efficiently train warfighters to achieve peak performance across diverse roles, under extreme conditions.

Nutritionally Sustained: Driving innovation and quality in the design and provision of combat rations and fresh food, as the ADFs trusted experts on food and nutrition in a military context.

Augmented Close Combatant: Working closely with Army and CASG through the Diggerworks partnership has delivered a world class Soldier Combat System that continues to evolve to meet the emerging threats and opportunities for close combatant superiority.

Augmented Vehicle Occupant: Field and Lab experimentation that reduce injury vulnerability and raise the human-system performance of Army's new combat vehicle acquisitions.



S&T Excellence

Three year publication record

68 DSTO Technical Reports94 DSTO Client Reports52 Journal Publications108 Conference Papers

Peer Recognition

- Chair TTCP HUM Group
- Chair TTCP HUM JP1 Land Human System Performance
- National Lead TTCP LND TP5 Warfighter Survivability
- ICSPP Conference Chair
- · Over ten university appointments
- Professional memberships held by the majority of staff.

Awards

- Minister's Award for Defence Science 2015 (M Patterson)
- Comcare Work Health and Safety Award 2016
- College of Sport & Exercise
 Psychologists Award of Distinction
 2016
- Traffic and Transport Psychology Young Scientist Award 2016
- APS College of Organisational Psychologists (SA) Award 2016

PARTNERSHIPS & OUTREACH

Universities

Human Performance Research Network (HPRnet) University of Wollongong University of Tasmania Griffith University

Industry

Rheinmetall SA Cobalt Alertness CRC

Government

Australian Institute of Sport CSIRO AFP

International

TTCP HUM and LND Groups NATO STO DSTA (Singapore) NSRDEC (US)



Land Vehicles and Systems

Goal

To enhance the Land Force's ability to survive and win in challenging environments by delivering novel land systems concepts and solutions

Impact

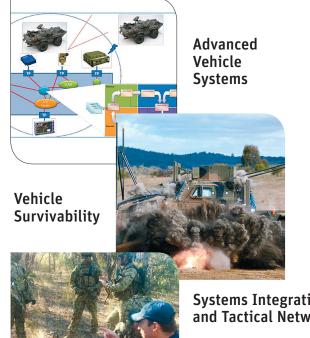
Vehicle Survivability: Increased ballistic and blast survivability of land vehicles and their crews through R&D in multi-role armour systems, predictive modelling, protective appliqués, improved materials and cabin survival systems.

Resilient Mission Systems: Developing resilient vehicle hosted mission systems that adapt dynamically in demanding situations, thus reducing the cognitive burden of operators and making Australia's land vehicles more potent.

Enhanced and Survivable Combat Service Support:

Developing, exploring and exploiting CSS concepts and technologies, such as autonomous logistics, to enhance CSS efficiency and survivability in complex environments.

Resilient Tactical C2 Information Networks: Collaborating with academia and the Army Research Labs to research and develop information management solutions with greater autonomy, resilience, trust and quality of service of the tactical information network in complex environments.



Land Logistics





S&T Excellence

Three year publication record

54 DST Technical Reports

68 DST Client Reports

21 Journal Publications

27 Conference Papers

3 Book chapters

Peer Recognition

- 5 PhD Supervisors
- 2 University adjuncts
- 1 Principal Scientist
- 1 Defence Science Fellowship
- 3 Journal reviewers
- 1 Chair of International Symposia
- TTCP LND Group
- · Chair of the International Council of Systems Engineering 's Model-based Conceptual Design Working Group

Awards

- Land Defence Australia Young Innovator Scholarship 2016
- DMTC Early Career Award 2016
- INCOSE Award for Leadership 2013
- Commander CDG Gold Commendation 2014
- DST Group Achievement Awards 2016

PARTNERSHIPS & OUTREACH

Universities

University of NSW **RMIT University Deakin University** Melbourne University **Adelaide University**

Industry

BAE Systems **Defence Materials Technology Centre** Thales Australia **Ambrose** Myriota

International

TTCP LND Group Dstl (UK) DRDC (CA) Tank Automotive Research, Development and Engineering Center (US) **DSTA** (Singapore) NATO STO **EMI Germany**



Chemical and Biological Defence

Goal

Lead the application of Biology, Chemistry and related disciplines to inform, safeguard and mitigate the risk posed by chemical and biological threats to personnel and missions of Defence and National Security organisations.

Impact

Hazard Management and Individual Protective Equipment:

Develop and assess CBRN protective equipment, detectors and decontamination systems that provide ADF with more effective capability to survive and operate within CBRN environments.

Agent Chemistry & Verification: Application of R&D to assess the hazards posed by chemical agents and toxins and verify their alleged use. This will enable Defence to better prepare for the challenges posed by chemicals of concern and allow attribution of chemicals to sources and/or individuals, assisting law enforcement agencies and the Organisation for the Prohibition of Chemical Weapons (OPCW).

Bio-agent Identification & Characterisation: Application of R&D in virology and development and evaluation of detection and diagnostics platforms for biosurveillance and health monitoring. The work has resulted in international and national collaboration to evaluate platforms, the development of a potential in-field assay for bio-warfare agents and informed advice to CASG projects. Special Operations Engineering Regiment and Joint Health Command.



Characterisation

Agent-based **Genomics &** Cell Biology

S&T Excellence

Three year publication record

 DSTO Technical Reports DSTO Client Reports Journal Publications Conference Papers

Peer Recognition

- 1 ARC assessor
- 2 PhD thesis assessors
- 1 PhD supervisor
- 4 DSF and 3 CDS Fellows
- 5 Journal reviewers
- · Chair of the International CBR MOU
- 2 S&T advisors to the Australia Group
- Executive Committee members for CWALN
- National S&T lead for Medical Counter Measures Consortium
- 2 Chairs of International Symposia
- ISO and Australian Standard panels

Awards

- SP&I Award for Client Support 2016
- OPCW Hague award 2016
- DST Group Achievement Award 2015
- DST Group Best Client Support 2011
- AN7SMS Bowie Medal 2013

PARTNERSHIPS & OUTREACH

Universities

LaTrobe University University of Technology Sydney Monash University / Bio21 Macquarie University Garvan Institute of Medical Research RMIT University, University of NSW Swinburne University; Flinders University

Industry

Catapult Ideation Defence Materials Technology Centre

Government

CSTRO Defence Science Institute Army Malaria Institute Victorian Infectious Disease Research Laboratory **Berrimah Veterinary Labs**

International

Chemical and Biological Memorandum of Understanding (CBR MOU) Australia Group (forum for control of CBR weapons) Organisation for the Prohibition of

chemical Weapons (OPCW)

Chemical and Biological Weapons Conventions CTTSO and Department of Homeland Security (US) DRDC (CA) **DSTA** (Singapore) DTA (NZ)



Land Personnel Protection

Goal

Inform, protect and enable defence and national security personnel through advances in CBRN hazard analysis, physical protection systems, EM signature reduction and the use of autonomous systems.

Impact

Support to Operations: CBRN hazard modelling to optimise personnel protection and mission effectiveness for deployed ADF at threat from hazardous materials.

Force survivability: Improved camouflage and signature management for Army and advice on current combatant ballistic protection to enhance survivability of the individual combatant.

Support to Acquisition: Advice, R&D and T&E provided in the areas of signature management, power and energy and radiological science has enhanced the outcomes of acquisition projects such as LAND 3025, 121, 200, 400, 2110, JP199, 500, 8045.

Research and Development: Development of improved fragmentation and stab and spike protection for dismounted combatants and the development of standoff radiological imaging detection systems providing the ADF with capability advantage over potential adversaries.



S&T Excellence

Three year publication record

96 DST Technical Reports

10 DST Client Reports

41 Journal Publications

29 Conference Papers

1 Book

2 Book chapters

Peer Recognition

- 2 ARC Experts
- · 1 PhD Examiner
- 1 Defence Science Fellowship 2011-2014
- 3 International Associate Academics
- 2 Keynote Speaker Invitations

Awards

- DST Group Achievement Award for Science & Engineering Excellence 2016
- RAAF Commendation Medal 2014
- 2 Divisional Awards for Excellence 2014. 2015
- 3 Industry Innovation Awards 2014, 2015
- Fusion 2016, Best Paper Award 2nd runner-up

PARTNERSHIPS & OUTREACH

Universities

University of Melbourne RMIT University University of NSW

Industry

Bruck Textiles Wax Converter Textiles Bartlett Industrial Textiles ADA Tectonica A.C.E Body Armour

Government

ANSTO
Bureau of Meteorology
CSIRO
Geosciences Australia
Victorian Department of Health

International

CBR R&D Forum (AU/US/UK/CA)
DRDC (CA)
Dstl (UK)
US Army CERDEC, Naval Research Lab (US)
TTCP MAT and LND Groups
NATO STO
FTSD (Singapore)







Aerospace Division



Aerospace Systems Effectiveness

Goal

To support Defence outcomes in capability, efficiency and safety by providing advice and solutions where humans and air platforms or systems interact

Impact

Training for the Future Battlespace: Developing tools, techniques and metrics which are transforming ADF aerospace collective training to enable 5th generation operations. Shaping future Live, Virtual and Constructive training through the RAAF Joint Air Warfare Battle Lab.

Human Autonomy Teaming: Researching fundamental techniques to ensure the ADF fully harnesses the capabilities of current and future autonomous systems.

Human Performance: Providing advice on human cognition, human system interfaces and crewing concepts that impact the design and usage of ADF aerospace capabilities and the selection and training of aircrew.

Rotary Wing Systems Effectiveness: Providing advice that enables reduced risk and increased capability for rotary wing platforms operating in challenging environments. S&T analysis provides critical information for rotary wing accident investigations such as the 2011 CH-47D accident in Afghanistan.



S&T Excellence

Three year publication record

33 DST Technical reports **14** DST Client reports

7 Journal papers

35 Conference papers

Peer Recognition

- · 3 PhD supervisors
- 2 Defence Science Fellowships
- 1 TTCP Group National Representative,
- 3 TTCP Panel National Leads
- 1 TTCP Panel Chair
- 6 Professional memberships
- 1 Editorial Board membership

Awards

- Royal Aeronautical Society Award 2015
- CAF commendation 2014
- TTCP Award 2015
- Australia Day Medallion 2013
- DST Group Silver Award 2015
- Best Paper Award SimTecT 2013, 2014, 2015

PARTNERSHIPS & OUTREACH

Universities

University of Western Australia Western Sydney University RMIT University Deakin University University of Sydney Queensland University of Technology

Industry

AOS Boeing Elmtek Simsol AVT

ntek nsol T

Airbus Australia Group

GovernmentBureau of Meteorology

International

TTCP AER, HUM and JSA Groups NATO STO HFM-247 Panel AFRL AFOSR, ONRG, AMRDEC (US) University of Liverpool (UK) DSO (Singapore)



Aircraft Performance and Survivability

Goal

To ensure the operational effectiveness and survivability of the war-fighter by characterising and controlling ADF air signatures and systems performance, and by providing expert technical input to Intelligence assessment.

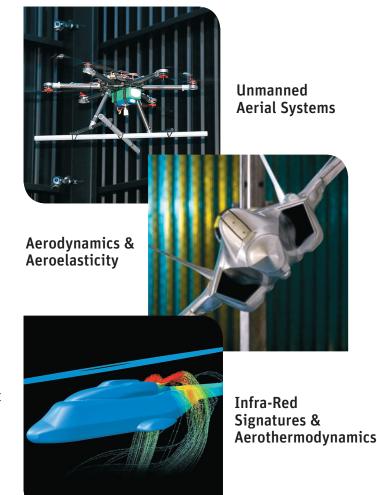
Impact

Operations: Enhanced Battle-worthiness of deployed ADF aircraft through validated Airborne Electronic Warfare Self-Protection systems; Validated safe carriage of weapons for deployed aircraft through vibration assessment advice.

Sustainment: Enhanced capability of JDAM weapon by range extension (JDAM-ER) through aerodynamic design, development, test and evaluation.

Platform Acquisition: Aerodynamics research conducted through an AUS/US Partnership on Weapons Integration under Project AIR 6000 has reduced the acquisition risk of the F-35. Demonstrated enhanced aircraft performance through aerodynamic and performance assessment of aircraft such as P-8 and UAVs.

Future Proofing: Undertaking S&T in autonomous UAV operations, multi-system teaming and IR signature control to support enhanced future ADF maritime capabilities.



S&T Excellence

Three year publication record

44 DST technical Reports

39 DST Client Reports

17 Journal Publications

91 Conference Papers

3 Chapters in NATO STO Report

Peer Recognition

- 1 University Advisory Committee
- 4 PhD Supervisors
- 1 NATO STO AVT Technical Panel Chair
- 2 TTCP AER Group National Leads
- Chair of the Supersonic Tunnel Association International (STAI)
- AIAA Membership

Awards

- 2 Prime Ministers Awards for Excellence in Public Sector Management 2013
- AFP Commendation for MH17 support 2015
- RAAF (DGSP) Commendation 2013
- 1 NATO STO SET Panel Achievement Award 2014
- DST Group Bronze Commendation 2015
- 2 Best Papers at 16th AIAC Conference 2015

PARTNERSHIPS & OUTREACH

Universities

Sydney University
RMIT University
Defence Science Institute
Monash University
University of South Australia
Melbourne University
University Queensland

Australian National University Deakin University University of NSW

Industry

Boeing (US)
AVTOL
ASE, DMTC
CAE Pty Ltd
Hardchrome
QinetiQ
Grollo Aerospace
Lockheed Martin

Government

Australian Federal Police Bureau of Meteorology

International

ATLA (Japan)
DSTA (Singapore)
TTCP AER Group
NATO STO AER Panel
Arnold Engineering Development
Complex (US)
USAF Seek Eagle Office (US AFSEO)

Cranfield University
Dstl (UK)
DLR (Germany)
Sandia Labs, NASA, USN,
USAF AFRL (US)
RCAF (CA)



Aircraft Health and Sustainment

Goal

Enable safe, supportable and affordable operation of ADF air vehicle fleets over their life-cycle through a focus on asset and health management technologies.

Impact

Safety: The ADF's trusted experts for support of accident / incident investigations. Delivery of enduring & enhanced aircraft system health management capability for on-going support to airworthiness.

Supportability/Affordability: Enhanced availability via aeromateriel state awareness technologies. Improved affordability & maintenance efficiency through analysis of LOT cost drivers.

Support to Operations: Measuring aircraft aural signatures for enhanced covert mission planning and survivability.

Future Force Experimentation: War gaming logistics con-ops & Air Force Plan Jericho Theme 11; Development of non-intrusive flight testing instrumentation (NIFTI) for on-demand flight trials.

Platform Acquisition: S&T advice to Defence projects: AIR 7000 (fleet size determination); AIR 9000 (HUMS technologies); AIR 6000 (propulsion system, vibration diagnostics and wear debris analysis).

Strategic Research: Autonomous material state awareness systems for enhanced availability; development of novel IR signature coatings for improved survivability.



Airframe Diagnostic Systems

Engines & Fuels Integrity



S&T Excellence

Three year publication record

40 DST Technical Reports

24 DST Client Reports

42 Journal Publications

34 Conference Papers

2 Book chapters

6 Patents

Peer Recognition

- 2 ARC Reviewers
- 1 CSIRO Endowment Fund Reviewer
- 4 PhD supervisors
- 3 Journal Associate Editors and Internal Scientific Boards
- 2 TTCP National Leads
- 1 External Course Advisory Committee
- 2 Conference Chairpersons

Awards

- US Office of Secretary of Defense Medal for Exceptional Public Service 2014
- RAeS Aviation Safety Award 2016
- TTCP Achievement Awards 2009, 2013
- Combined Joint Task Force 633 Silver Commendation 2013
- DST Bronze Commendation 2012, 2016
- · Australia Day Medallion 2016
- 9 DST Group awards since 2010
- DST Group Solvelt award 2015
- Best Conference Paper 2015

PARTNERSHIPS & OUTREACH

Universities

Monash University RMIT University Melbourne University Swinburne University Deakin University Adelaide University Sydney University

Industry

Defence Innovations Northrop Grumman Van Gelder and Monk Honeywell LRM Technologies Lockheed Martin

Government

Bureau of Meteorology Australian Synchrotron

International

TTCP AER and MAT Groups F-35 JSF S&T Advisory Board ABCANZ University of South Carolina (US) NRL, NSWC (US)



Airframe Technology and Safety

Goal

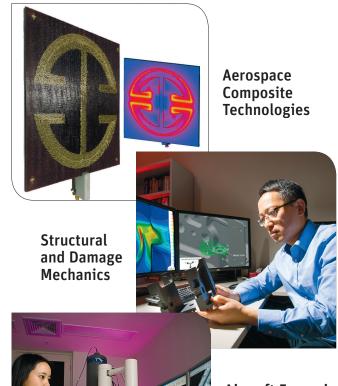
To maximise aircraft capability and safety through the development and application of leading edge computational modelling and materials systems research.

Impact

Operational capability: The operational capability of the F/A-18 fleet was restored in time for their deployment to operation OKRA achieved through the application of advanced metallographic assessment, computational modelling and biologically inspired shape optimisation of the SUU-62 centreline pylon.

Acquisition and safety: The safety of flight of the JSF fleet has been increased through the appropriate lifing of anodised components undertaken due to AT&S research into the effect of the anodising process on fatigue initiation.

Operational capability: The simultaneous operation of the satellite communications antenna and the ESM systems fitted to ANZAC Class ships was restored through the design, manufacture and installation of a low observable technology electromagnetic shield.



Aircraft Forensic and Metallic Technologies

S&T Excellence

Three year publication record

24 DST Technical Reports **401** DST Client Reports

50 Journal Publications

46 Conference Papers **4** Book chapters

Peer Recognition

- 5 PhD supervisors
- 3 PhD Examiners
- 12 Journal reviewers
- 1 International Journal Editorial Board
- ESDU Committee Panel member
- 1 CDS Fellowship
- 1 Adjunct Senior Research Fellow
- TTCP MAT Group National Leads for TP12 & TP13
- TTCP AER Group Panel Chair

Awards

- Jaap Schijve Award for young aeronautical engineers 2013
- TTCP AER Group Award 2014
- CDF Gold Commendation 2008, 2011
- RAN Silver Group Commendation 2012
- DST Group Achievement Awards for; Technical Excellence 2016, Outstanding Corporate Contribution 2015, Outstanding Early Career Achievement 2014
- Best Paper International Workshop on Antenna Technology 2016

PARTNERSHIPS & OUTREACH

Universities

Swinburne University University of Queensland Melbourne University Macquarie University La Trobe University

Deakin University Australian Synchrotron Monash University University of Sydney RMIT University

Industry

Qinetiq RUAG Australia BAE Systems Australia Airbus Group Asia Pacific Boeing Defence Australia DMTC Altair

Government

ANSTO AFP ATSB CASA CSIRO

International

NRC (CA)
University of Delaware
Norwegian Technology University
Franhofer ILT; dstl (UK); Renishaw Corp
Texas University; Mississippi State University
Lawrence Livermore National Laboratory (US)
International Accident Agencies: AAIB, NTSB,
BEA, BFU, TSB

TTCP AER and MAT Groups
NAVAIR, NAWC (USN)
AFRL; FractureLab (US)
IMP (CA)
University of Calif ,Davis (US)
Delft University (NL)



Aircraft Structures

Goal

To provide safety-critical aircraft structural integrity and airworthiness advice and solutions to the ADF through targeted partnerships, research and application of innovative science and technology.

Impact

Safety: The provision of critical test results and analyses as the evidence base required for airworthiness qualification under Australian configuration, usage and environment for aircraft such as the BAE Systems Hawk LIF & C-27J.

Costs: Advanced testing & analysis has provided Defence with significant cost avoidance or life extensions for aircraft such as F/A-18 Hornet (\$400M saved) & AP-3C (\$388M saved)

Capability: Ensuring full capability through maximising availability and readiness of air assets, eg, F/A-18 Hornet, PC-9 and AP-3C. Contributing to a sovereign industry capability for aircraft sustainment via industry alliances, eg, QinetiQ.

Acquisition: Contributing to ADF's smart-buyer status through rigorous technical risk assessments. Our science has influenced development programs that will lead to significant long term future benefits eg, F-35 structural durability.

Future: World leading science has contributed to the advancement of aircraft structural integrity testing and analysis resulting in enhanced capability for ADF aircraft.



S&T Excellence

Three year publication record

25 DST Technical Reports

4 DST Client Reports

35 Iournal articles

24 Conference papers

1 Book Chapter

Peer Recognition

- ARC Expert College member
- 2 PhD examiners
- · Editorial Board member
- TTCP AER Group National Lead
- · National Delegate International Committee on Aeronautical Fatigue & Structural Integrity

Awards

- Order of Australia AM 2016 (L Molent)
- Public Service Medal 2015 (S Barter)
- · Minister's Award for Defence Science 2010 (L Molent)
- 2 TTCP AER Group Awards 2012, 2014
- Operational Service Medal (AOSM) -Civilian 2013
- · Client Commendations: DCAF 2014, PM NACC 2013, CASA 2012, Dir AEPM 2011, DMO Engineering Award 2011
- Australia Day Medallions 2011, 2012
- · DST Achievement Awards; Outstanding Contribution to Defence Outcomes 2011. Best Corporate Contribution 2012
- British Society for Strain Measurement, Best Paper Award 2015
- Best Paper in J. Expt Mech 2016

PARTNERSHIPS & OUTREACH

Universities

RMIT University Monash University **University of NSW Canberra** Swinburne University Melbourne University

Industry

OinetiO Boeing **BAE Systems** AGAP RUAG

Northrop Grumman Lockheed Martin

Government CASA

TTCP AER Group **NATO STO** RAF, Dstl (UK) RCAF, NRC, Bombardier (CA) USN NAVAIR, USAF AFRL & LMLC (US) RNZAF, DTA (NZ)

International

Armasuisse (Switzerland) Finnish Air Force **Leonardo - Finmechanica** (Italy) Delft University (NL) Southampton University (UK)



Applied Hypersonics

Goal

Hypersonic research and flight testing. Technology development for high speed propulsion used in air vehicles travelling at speeds in excess of Mach 5. Provision of expert advice to Defence on emerging hypersonic systems.

Impact

Future Proofing: Research and development of technologies for future hypersonic flight vehicles will provide Defence with options to both generate and counter strategic surprise.

Strategic Research: Research into 'game-changing' defence technology with specific application to hypersonic tactical systems and hypersonic surveillance systems and the generation of knowledge essential for the transition of hypersonic technologies into service will enable Defence to take advantage of future strategic options.

Emerging Futures: Development of expertise necessary to inform policy decisions, shape Defence requirements, aide acquisition and to provide insight into operation of future hypersonic systems provides Defence with S&T expertise not otherwise available.



S&T Excellence

Three year publication record

17 HiFIRE Technical Reports

1 Journal Publication

1 Conference Publication

Peer Recognition

 2 Adjunct Professorships (University of Queensland)

Awards

- ICAS Von Karman Award for International Cooperation in 2012
- Divisional Award for Best Research 2013
- · Divisional Award for Best Research 2010

PARTNERSHIPS & OUTREACH

Universities

RMIT University University of Queensland (UQ) University of NSW University of Southern Queensland Industry
BAE Systems
DefendTex
DMTC

Government

Oueensland Government

International

AFRL, AFOSR (US)
Boeing
QinetiQ
Go Hypersonics
Lockheed Martin
German Aerospace Center (DLR)
University of Minnesota







Joint and Operations Analysis Division



Aerospace Capability Analysis

Goal

To enhance ADF aerospace capability by providing expert, impartial, scientific advice informing acquisition decisions, supporting operations, and future - proofing Defence capability.

Impact

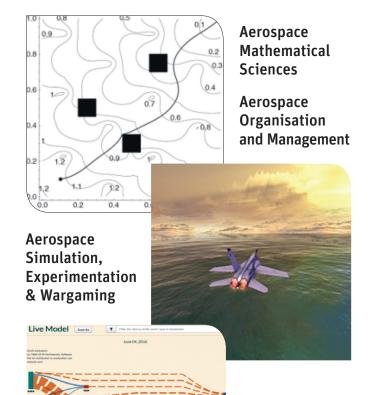
Aerospace Project Support: Supporting introduction into service of aerospace platforms such as F-35A, EA-18G, P-8A and MH-60R. Analysis is focused on integration into the wider force, informing CONOPS/tactics development and informing upgrade decisions.

Air Force Experimentation: Tested concepts of operations against planned force structure to inform Air Force about its future roles in delivering joint operational effects.

Plan Jericho: S&T research and advice has enabled broadening of capability options and developed innovative applications of new technology (HoloLens).

Air Warfare Centre: Established OA capability to allow Air Force to develop integrated air warfighting tactics (e.g. USAF Red Flag, RAAF Pitch Black).

Training Pipeline Analysis: Working with ADF aircrew training establishments to optimise training pipelines, including automation of course scheduling, improved data visualisation and resource use.



Aerospace Systems Analysis

International

S&T Excellence

Three year publication record

15 DST Technical Reports

30 DST Client Reports **24** Journal Publications

51 Conference Papers

Peer Recognition

- ARC Partner Investigator
- Adjunct Professor University of Melbourne
- Scientific Editor J. App. Econ.
- · Journal reviewers: IEEE, Defence Technology & Electronics Letters

Awards

- AFP Commissioner's Certificate 2016 for MH17 investigation support
- ADF Gold 2011, Silver 2016, and Bronze 2016 Commendations for Rotary Wing work program
- Defence Operations Research Symposium best paper awards 2014 & 2015

PARTNERSHIPS & OUTREACH

Universities

RMIT University University of Melbourne University of South Australia University of Tasmania University of Queensland University of Western Australia **University of NSW Canberra**

Industry

Boeing Northrop Grumman **SAAB Australia** RAND

Government

AFP

TTCP AER Group **USAF HQ AFRL University of Utah**

Dstl, UK Air Warfare Centre, (UK) USN NAVAIR, OPNAV, NPS, NLR **Glasgow University**

Georgia Tech Research Institute



Land Capability Analysis

Goal

To provide evidence and analysis to support decisions on Land force structure and capabilities, focussing on operational effectiveness through applying and developing operations research methods, tools and techniques.

Impact

Close combat: Evaluation of contributions made by elements of the Combined Arms Teams to close combat effectiveness is ensuring that Army has the required mix of capabilities to succeed at close combat into the future.

Ground combat enablers: Assessment and advice of the impact of various land combat enablers including situational understanding, C3 and combat support, as well as joint enablers, on the operational effectiveness of the reinforced combat brigade engaged in joint land manoeuvre.

Shape future Army: Providing whole of force evidence to support Army in the design and development of a robust and adaptive force for joint interagency land operations.

Analytical Wargaming: Developing a wargaming capability that fosters the application of wargaming analytical models and techniques for joint and land force design.



S&T Excellence

Three year publication record

15 DST Technical Reports

47 DST Client Reports

11 Journal Publications

27 Conference Papers

1 Book Chapter

Peer Recognition

- TTCP LND Group National Lead for TP1 Soldier Combat Systems
- TTCP Contested Urban Environment Strategic Challenge Group, National Lead
- Military Operations Research Society, Board representative for Australia
- Australian Society for Operations Research (ASOR) member
- Australasian Bayesian Network Society; President-Elect

Awards

- Australian Army commendations 2012
- DST Group Bronze Commendation 2013
- Australia Day Award 2014
- · 85th Barchi Prize Nomination
- Morry Frost Operations Research Award 2014

PARTNERSHIPS & OUTREACH

Universities

University of South Australia Deakin University Monash University University of NSW Canberra Curtin University Monash University

Industry

YTEK
Averill M. Law & Associates, Inc.
RAND
Ground Effects
Elmtek
Blue Swimmer
Consilium

International

TTCP LND Group
Naval Postgraduate School
US Army Training and Doctrine Command
Analysis Center (TRAC)
US Center of Army Analysis (CAA)
Dstl, Cranfield University (UK)



Maritime Capability Analysis

Goal

To support evidence-based decisions on Navy's Force structure, concepts, acquisition of systems, operational effectiveness and capability management

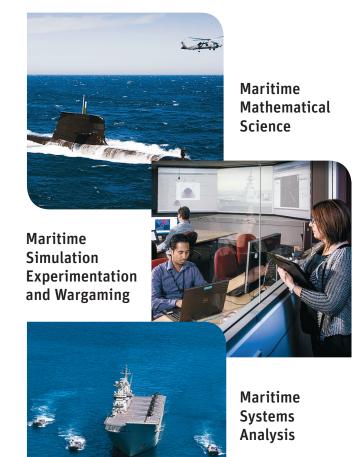
Impact

Future Force: Conducting experimentation and analysis for Navy Strategic Command to support future warfighting concepts and force design. Established the needs case for Future Frigate.

Acquisition Projects: Combining operational knowledge with performance modelling to provide evidence informing decisions on requirements and options for maritime projects including Future Submarine and Future Frigate.

Current Fleet operations: Conducted research to support Fleet Command in transitioning from single-ship to Task Group level operations. Assessing the effectiveness of the surface and subsurface fleet informs major projects and Navy's Maritime Warfare Program.

Fleet Data: The Navy's assessment of operational performance, fleet optimisation, gap identification and exercise analysis has been enhanced through the development of a big data repository and an agile and comprehensive data analytics capability.



S&T Excellence

Three year publication record

17 DST Technical Reports

28 DST Client Reports

10 Journal Publications

19 Conference Papers

1 Book Chapter

Peer Recognition

- 1 Academic board membership -University of NSW
- 1 ARC Assessor
- Journal reviewers for; Ergonomics, SysEng, Ethics and IT
- ASOR National Conference secretary
- Professional Memberships of AustMS, IEEE, MORS, MSSANZ

Awards

- TTCP award 2014
- RAN Fleet Commander Bronze Commendation 2015
- DST Group Achievement Award for Outstanding Communication of S&T 2015, 2016
- Australia Day Medallion 2012
- Best Papers Defence Operations Research Symposium 2014, 2016

PARTNERSHIPS & OUTREACH

Universities

Australian National University Macquarie University University of NSW RMIT University University of Adelaide **Industry** RAND

RAND
Defence Science Institute

International

TTCP MAR Group Maritime Warfare Centre (UK) UK, NZ & Netherlands Navies US Navy/US Marine Corps Indian Navy Pakistan Navy University of Bristol University of Cambridge UK Royal Society



Joint Capability Analysis

Goal

Support and enhance current and future Joint Force operations through the application of systems engineering, mathematical models, organisation and social science techniques, simulations, experimentation and operations research.

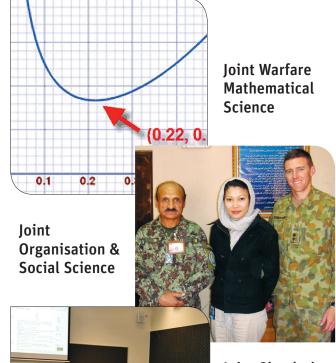
Impact

Integration by Design: Influence the development and adoption within the ADO of System of Systems engineering to achieve integration by design.

Project interdependencies: Analyse and evaluate system interdependencies to inform VCDF of Project interdependencies within the Integrated Investment Program (IIP).

Joint Concepts Experimentation: Through undertaking testing and evaluation of concepts such as Joint Fires the ADF is better prepared and has an enhanced understanding of how to operate in complex joint operations.

Support to Operations: Enhanced mission effectiveness and reduced operational risk to the deployed force has resulted from the coordinated DST Group support to operations program. Research into improved methods to understand the human and cultural environment has provided key inputs into operational planning and conduct.



Joint Simulation, Experimentation & Wargaming

Defence Systems Integration

S&T Excellence

Three year publication record

40 DST Technical Reports21 DST Client Reports50 Conference Papers6 Journal Publications

Peer Recognition

- Honorary Senior Research Fellow Oxford University
- Vice President Australian Society for Operations Research (ASOR)
- TTCP JSA Group Technical Panel 4 National Lead

Awards

- Australasian Evaluation Society Prize; Best Public Sector Evaluation 2013
- TTCP award (Systems of Systems Engineering) 2015
- Defence Gold Commendation 2013
- Defence Silver Commendation 2011

PARTNERSHIPS & OUTREACH

Universities

University of Adelaide University of Wollongong Deakin University Flinders University University of NSW Canberra

Industry

Government AFP DFAT Australian Civil Military Centre (ACMC)

International

TTCP JSA Group
DSTA (Singapore)
Dstl (UK)
Foreign & Commonwealth Office (UK)
Stabilisation Unit (UK)
University of Oxford
Kings College London



Strategic Capability Analysis

Goal

Aims to shape Defence and National security policy, strategy and capability by being DST Group's lead analytical capability for: Horizon scanning and technology foresight; Strategic context, risks and mitigation approaches; and, future whole-of-force design, force level capability trade-off analysis and prioritisation

Impact

Defence strategic planning is informed by:

Technology Foresighting: Impact of future environments and emerging technologies through Emerging and Disruptive Technology Assessment Symposia (EDTAS) and S&T Strategic Outlook.

Force Design: Analytical support to Defence's strong strategic centre is integral to VCDF's new Force Design approach and has a strong client embed model.

Strategic Analysis: Supporting identification and assessment of risks to Defence strategic policy, developing methods for, and supporting the analysis of strategic investment priorities to enhance Defence resilience, notably Defence's energy security.



S&T Excellence

Three year publication record

19 DST Technical Reports6 DST Client Reports

13 Journal Publications

45 Conference Papers

Peer Recognition

- ANU Honorary Associate Professor
- ARC Grant Assessor
- · ADFA Defence Grants Board
- Secretary of Defence Fellowship 2012, 2014
- CDS Fellowship 2016
- Defence International Fellowship 2015
- ADFJ Editorial Board
- TTCP JSA Group technical panel leads for TP-3 & TP-9
- Fellow of Dr. Schöller Research Center for Business and Society, Germany
- Members of; Australian Society of Operations Research, Institute for Regional Security, IEEE

Awards

- Defence Gold Awards 2011, 2014, 2016
- Australian Operational Service Medal 2015
- Best Paper InSITE 2014

PARTNERSHIPS & OUTREACH

Universities

Australian Academy of Science Australian National University Flinders University Industry

Noetic Australian Strategic Policy Institute Government

Attorney General's Department

International

TTCP JSA Group, Technical Panels 3 and 9
Dstl (UK)



Decision Sciences

Goal

Decision Sciences enables Defence and National Security to achieve a capability edge in decision making at the strategic and operational levels.

Impact

Fuel Network Review: Provision of advice and tools that assists Joint Logistics Command in understanding the Defence fuel network and its critical weaknesses and limitations.

Directorate of Strategic Fuels: Advice on logistics estimate of surge requirements and supply options for marine and aviation fuels informing defence storage and supply contracts.

Commander: Decision instrument used by Australian Defence College to improve Joint Professional Military Education.

Situation Awareness Tools: Development of tools to enhance situation awareness in operations and exercises which were used by HQJOC in Op Fiji Assist.

HQJOC and **HQ 1Div Modernisation**: Data collection, analysis, modelling and simulation contributing to organisational enhancement.

5th Gen HQ Conceptualisation: Informing the development of next generation HQ structures and functions.



S&T Excellence

Three year publication record

16 DST Technical Reports

9 DST Client Reports

34 Journal Publications

33 Conference Papers

1 Book

Peer Recognition

- 2 Academic Board Memberships
- 2 Academic Fellows
- · One CDS fellowship
- One Principal Scientist

Awards

- Defence Fellowship 2013-2016
- Secretary of Defence Fellowship 2014-2015
- ADF Journal Best Paper 2015
- Alphonse Chapanis Best Student Paper Award 2016

PARTNERSHIPS & OUTREACH

Universities

University of South Australia Melbourne University Australian National University University of Adelaide

Industry

Consunet Pty Ltd. Elmtek Pty ltd. KIAH Consulting Data to Decisions CRC

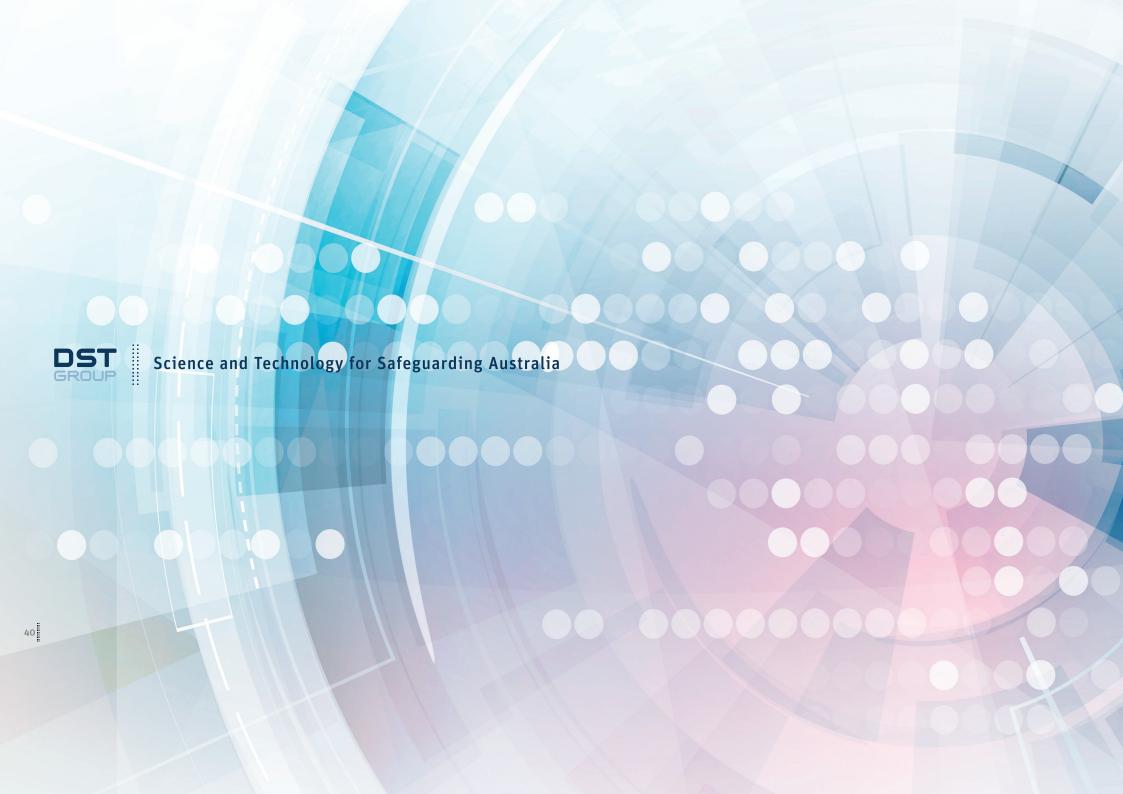
Government

Bureau of Meteorology

International

TTCP C3I Group SPAWAR (US) University of Southampton CTTSO (US)







Cyber and Electronic Warfare Division



Science and Technology for Safeguarding Australia

Cyber Assurance and Operations

Goal

Enable autonomous, resilient and effective cyber capabilities with an operational edge in the face of ubiquitous encryption, untrustworthy ICT and a highly dynamic, sophisticated and perimeter-less threat environment.

Impact

Cryptologic capability: Application of expertise in cryptology and information assurance has ensured the safety and security of ADF troops and Australian government communications.

Trustworthy Systems: Increasing cyber resilience with the development and trials of prototype computer security devices in Defence and other government agencies.

Cyber Defensive Capabilities: Delivery of new cyber defensive capabilities to the Australian Cyber Security Centre (ACSC) and the Defence Security Operations Centre (DSOC)

Supporting Cyber Operational Capabilities: Provision of critical support to Defence and Australian Government agencies in cyber operations.

Providing Cyber Subject Matter Experts (SMEs): Integrees and secondees have provided highly valued contributions to clients, resulting in greatly improved effectiveness and innovative solutions.improved data visualisation and resource use.



S&T Excellence

Three year publication record

30 DST Technical Reports

7 DST Client Reports

4 Journal Publications

11 Conference Papers

10 joint publications

Peer Recognition

- Adjunct position & three visiting fellows at Australian National University (ANU)
- Advisory board Australian Centre for Cyber Security (ACCS)
- Journal reviewers Microprocessors and Microsystems, ACM Computing Surveys
- Conference Program Committees Australasian Information Security Conference, Australian Cyber Security Centre Conference, Australasian Web Conference

Awards

- Prime Minister's letter of appreciation 2014
- Commendation from US Department of Homeland Security 2015
- ASD Merit Award 2016
- 2 ASD Exceptional Achievement Awards 2016
- ASD Australia Day Awards 2014, 2016
- 2 ASD Certificates of Appreciation 2015
- AISC Best Paper 2015
- South Australian iAward 2014

PARTNERSHIPS & OUTREACH

Universities

University of NSW Australian National University University of South Australia Defence Science Institute University of Wollongong, Edith Cowan University Deakin University, Macquarie University

Industry

Northrop Grumman
Cyber Security Growth Centre

Government

Data61/CSIRO

International

TTCP Cyber Security Challenge US Department of Homeland Security Dstl (UK) University of Waikato (NZ)



Cyber Sensing and Shaping

Goal

Delivery of concepts techniques and technologies for sensing and shaping modern communication networks to address challenges in cyber and related areas of signals intelligence.

Impact

Operational Support: To the Australian Intelligence Community and ADF through provisioning of unique S&T capability and SME advice; enduring presence at the Joint Defence Facility Pine Gap (JDFPG).

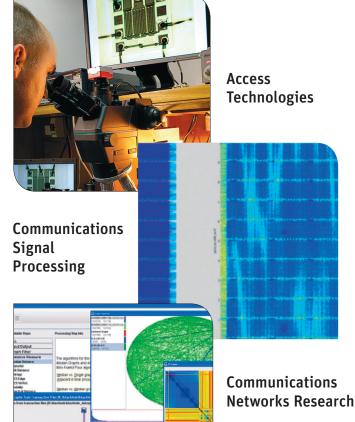
Facilitate Cyber Operations across the EM spectrum:

Development and operational deployment in 2016 of physical and cross-layer signal processing with innovative physical-to-network layer technologies for the security and exploitation of fixed and wireless telecommunications and free space optical networks.

Support to Cyber Network Situational Awareness:

Develop operational solutions to enhance network knowledge through characterisation, modelling and analysis of telecommunication core networks.

Advanced technologies: Development and delivery of specialised body worn antennas and SDR-based waveforms for cyber access and tailored wireless links.



S&T Excellence

Three year publication record

36 DST Technical Reports **5** Journal articles **23** Conference Papers

Peer Recognition

- 2 adjunct academics
- TTCP Cyber Strategic Challenge National Lead
- TTCP Cyber Strategic Challenge **EM Cyber Lead**
- Joint Chair of SIGINT Applications of Network Analysis Research (SANAR) organising committee

Awards

- Australia dav medallion 2013
- Five Eyes SIGINT awards 2014, 2017
- CEWD award for client impact 2015

PARTNERSHIPS & OUTREACH

Universities

University of Adelaide University of South Australia Australian National University Swinburne University **University of New South Wales**

Industry

Ebor Data to Decisions (D2D) CRC **Quintessence Labs**

Government

National Security Agencies CSIRO / Data 61

International

Five Eves International Joint Program at JDFPG NATO STO NRL (US) TTCP Cyber Strategic Challenge **US DHS**



Assured Communications

Goal

Develop survivable tactical communications and electronic warfare solutions for contested and denied cyber electromagnetic environments.

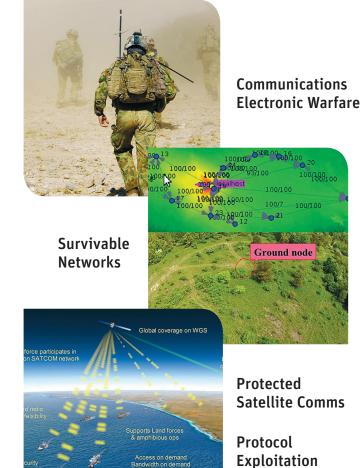
Impact

Saving Lives: Prevent battlefield casualties of ADF and coalition soldiers by developing practical systems that defeat improvised explosive devices for production on an industrial scale. 160,000 units delivered & hundreds of lives saved in the last few years.

Protected Satellite Communications: Delivered specialised satellite communications for submarines and land vehicles on the move. Built customised communications monitoring & management systems for ADF network operations centre.

Survivable Network Research: Developed autonomous UAV systems that can maintain radio communications networks that are under electronic warfare attack.

Protocol Exploitation: Developing machine learning systems that can respond to novel cyber and electronic warfare attacks in real time. Developing solutions to mitigate radio interference.



S&T Excellence

Three year publication record

39 DST Technical Reports58 DST Client Reports5 Journal Publications23 Conference Papers

Peer Recognition

- Adjunct professor University of South Australia
- · PhD co-supervisor
- TTCP C3I Group Technical Panel lead

Awards

- Public Service Innovation Award REDWING Team 2016
- Chief of Army Commendation for Counter IED 2014
- Chief of Navy Commendation 2015
- DST Award MH370 Aircraft investigation 2015
- Best Paper Land Forces Conference 2016

PARTNERSHIPS & OUTREACH

Universities

University of Adelaide University of South Australia Monash University University of New South Wales

Industry

Micreo, Ultra Avalon, Lintek Diemould, AES IMP

Government

Attorney General's Department ANZ Counter-terrorism Centre State & Federal Police Air Transport Safety Bureau

8Mbps TDMA network

International

TTCP EWS and C3I Groups TTCP Cyber Challenge USN Postgraduate School, SPAWAR US Army CERDEC Five-Eyes Working Group



Systemic Protection and Effects

Goal

Maximise Australian Defence & National Security capability through the development and delivery of solutions for the integration of force-level Cyber and Electronic Warfare (EW) with effective command & control.

Impact

Joint Force Level Electronic Warfare (JFLEW): Supporting the implementation of JFLEW through close engagement with Airborne Electronic Attack and Joint Intelligence, Surveillance, Reconnaissance and EW (ISR&EW) Defence programs as well as experimentation with user groups, international exercises and engagement with overseas partners developing C2 tools for this application.

F/A-18 threat geolocation: Working closely with the US Navy to jointly develop significant improvements to USN and Defence's emitter location and classification capability that is in the process of being fitted to Australian Air Force and US Navy aircraft.

Position Navigation and Timing (PNT) resilience:

Contributing to the assured access of PNT for the ADF. Enabling training and OT&E opportunities in GPS degraded environments. Development and application of advanced PNT threat concepts.



S&T Excellence

Three year publication record

14 DST Technical Reports

15 DST Client Reports

7 Journal Publications

17 Conference Papers

1 Book Chapter

Peer Recognition

- Two adjunct professorships Adelaide University & University of South Australia
- TTCP EWS Group and Panel national leads

Awards

- USN Commendation 2016
- TTCP Award 2016
- 3 DST Group Commendations

PARTNERSHIPS & OUTREACH

Universities

Australian National University Adelaide University University of NSW

Industry

Aerosonde (AAI) Consunet, Swordfish Simbiant SAAB GPSat Systems

Government

National Positioning Infrastructure

International

TTCP EWS Group USAF USN NRL US Geo-spatial Agency DRDC (CA) Five-Eyes. 11-Eyes



Spectrum Sensing and Shaping

Goal

To develop & transition RF technologies, techniques & systems that sense & shape the EM Battlespace to support EW, SIGINT & Cyber operations, in complex, contested & congested EM environments.

Impact

Nulka: Ongoing support to multiple phases of SEA 1397, ensuring the protection of RAN major combatants against current & future anti-ship missile threats. Development of RF technologies & low size weight & power electronic warfare payloads to support the future force.

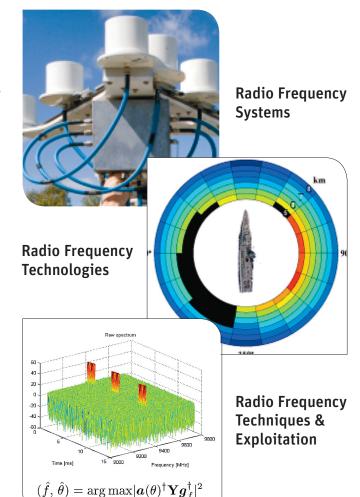
Wideband & Multi-channel Digital Electronic Support Systems: Development & transition of world leading wideband & multi-

channel digital electronic support systems for improved ADF electronic support & signals intelligence capabilities. Prototype wideband system used in cooperative program with US Navy.

Electronic Support & Signals Intelligence Data Deluge:

Development & transition of algorithms & applications to enhance ADF electronic support & signals intelligence capabilities in future EM operating environments.

Enhanced Situational Awareness: Development & transition of algorithms & applications to enhance ADF situational awareness, including environmental effects, in future EM operating environments.



S&T Excellence

Three year publication record

8 DST Technical Reports

6 DST Client Reports

19 Journal articles

43 Conference Papers

Peer Recognition

- 4 Adjunct Senior Lecturers
- 3 PhD Co-supervisors
- Advisory committee Adelaide University
- TTCP EWS Group TP6 National Leader

Awards

- DST Group Achievement Award 2015, 2016
- DST Group Team Bronze Commendation 2015 (2), 2016
- First prize student paper 2015
- Top 3 most downloaded papers in IEEE Transactions on Antennas & Propagation, 2015

PARTNERSHIPS & OUTREACH

Universities

Macquarie University Adelaide University University of Sydney Flinders University

Industry Micreo

BAE Systems
Ultra Electronics
Jenkins Engineering Defence Systems
Solinov, Macom, Lintech
Puzzle Precision, Curtiss-Wright

Government

CSIRO Bureau of Meteorology Australian Institute of Marine Science

International

TTCP EWS Group
US Navy; ONR, NAVAIR, NAVSEA, SPAWAR
Dstl (UK)
Arizona State University
Air & Space Interoperability Council (Five Eyes)



Electronic Warfare Operations

Goal

To enhance the survivability of the ADF by understanding, detecting and defeating threats using the electromagnetic spectrum.

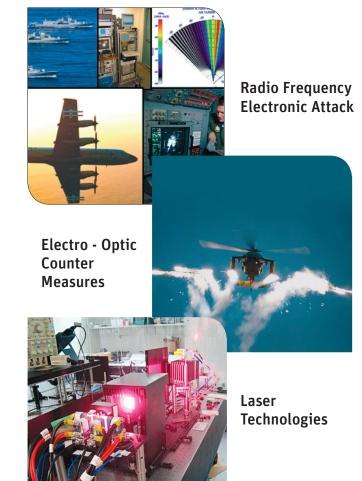
Impact

Countermeasure Development & Validation: Initiation and delivery of a RAAF/DST process that has reached final operating capability which enhances airborne platform battle-worthiness through the development and validation of electronic countermeasures of 13 ADF aircraft types.

Laser Technology Development & Licensing: World leading mid-infrared fibre laser technology enabling future "game changing" battlespace capabilities with a strong record in S&T excellence, innovation, and a growing IP portfolio. Technology transfer of a Directed Infrared Counter Measure (DIRCM) laser to Defence Industry through a licensing agreement.

Current and Future ADF Platform Protection:

Theoretical research, hardware-in-the-loop testing and field experimentation demonstrating the survivability of current and future ADF platforms. Survivability can be enhanced through advanced Radio Frequency Electronic Attack techniques in a layered defence.



S&T Excellence

Three year publication record

54 DST Technical Reports

44 DST Client Reports

87 External Publications

21 Joint Publications

Peer Recognition

- 1 ARC assessor
- 1 University board member
- Adjunct Senior Lecturer (USA)
- Australian Institute of Physics National Executive member
- PhD co-supervisor
- TTCP EWS National lead

Awards

- Public Service Medal 2012 (M Pitt)
- PM's Award for Excellence in Public Sector Management 2013
- PM's Award for Innovation 2013
- Australia Day Medallion 2012, 2016
- UK MoD CSA Commendation Award 2013
- 2 NATO STO Awards 2013, 2014
- 211/110 510 / Walas 2015, 201
- TTCP Achievement Award 2012
- Defence Support Services Commendation Gold and Bronze Awards 2015
- 4 DST Awards 2012, 2013, 2014, 2015
- SPIE best paper award 2015

World Records

- 400 W 2.1um CW fibre laser
- 99 W MWIR DIRCM laser source

PARTNERSHIPS & OUTREACH

Universities

Adelaide University University of South Australia Macquarie University University of Sydney Flinders University

Industry

BAE Systems
Airbus Group Australia Pacific
Chemring
Thales
elmTek
SysTech
Sub-Micron
Aether Photonics

Government AFP

ent

International

TTCP EWS Group NATO STO Dstl (UK) DRDC (CA) MELCO, Shinkosha (JPN) Airbus DS, DESY (GER) AFRL, NRL, ONR (US)
NAVSEA, NAVAIR, NSWC (US)
MSIC/ NASIC, ASE/CTE (US)
Nufern (US)
ADD-ROK (Korea)
University of Southampton
Rochester Institute



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Weapons and Combat Systems Division



Tactical Systems Integration

Goal

To enable the ADF to conduct joint and coalition tactical operations with seamless integration and interoperability of current, planned and next generation platforms and systems with tactical decision superiority and high degrees of automation and autonomy.

Impact

Interoperability: Enhanced interoperability through intrinsically interoperable tactical battlespace architectures for advanced joint tactical systems.

Open Architectures: Intrinsically secure and adaptable systems through open, modular, distributed and scalable tactical systems architectures.

Decision Superiority: Timely and effective tactical force-level response decisions through increased use of automation/autonomy and operator decision aids.

Human teaming: Enhanced tactical mission effectiveness through improved team composition, operations room design, and Human-human, humanmachine and autonomous/automated teaming.



S&T Excellence

Three year publication record

3 DSTO Technical Reports

9 DSTO Client Reports

2 Journal Publications

10 Conference Papers

2 Book Chapters

Peer Recognition

- 4 Society Memberships
- 1 ARC Examiner
- 1 Adjunct Position
- 5 Iournal Reviewers

Awards

- Australia Day Council Award 2016
- 2 TTCP Awards 2016
- DST Group award 2016

PARTNERSHIPS & OUTREACH

Universities

University of Adelaide University of South Australia University of Western Sydney

Industry

Boeing Defence Australia SAAB Australia Lockheed Martin Aerospace BAE Systems

International

TTCP AER, MAR, LND and HUM Groups NATO STO US Navy Dstl (UK) DRDC (CA) Object Management Group



Tactical System Performance Assessment

Goal

To enable a tactical performance advantage for the ADF in complex contested environments, underpinned by innovation in modelling, simulation, analysis and experimentation.

Impact

Weapons Technical Intelligence - Applying modelling and simulation of threat weapon systems to the MH17 incident has lead to a better understanding of what really happened.

Integrated Air and Missile Defence - An integrated, closed loop simulation of a real threat scenario resulted in development of optimised tactics for Naval survival.

Integrated Air and Missile Defence - Conducting a virtual experiment of the Frigate ops room layout has reduced the risk of a sub-optimal ops room design for SEA5000.

Land Active Protection Systems - Constructive modelling and simulation of Active Protection System concepts is enabling the evaluation and integration of future technologies for LAND400.



Tactical Systems Assessment

S&T Excellence

Three year publication record

13 DST Technical Reports **45** DST Client Reports **7** Conference Papers

Peer Recognition

- 2 ARC examiners
- 3 journal reviewers
- 6 Society memberships
- TTCP WPN Group TP8 National Lead

Awards

- Australian Intelligence Community Award 2016
- DST Group Achievement Award 2016
- 2 x CDS Gold Commendations 2016

PARTNERSHIPS & OUTREACH

Universities **Adelaide University** **Industry** Saab Australia Shoal Consilium

International

TTCP WPN Group Dstl, MBDA (UK) TNO (Netherlands) **NATO STO** DRDC (CA) **Intelligence Community** (5-eyes) **USN NAVSEA**



Weapon Systems Technologies

Goal

To apply the science and technology of sensors, intelligent processing and electromagnetic interactions to weapons and tactical systems to enhance war fighting capability in a complex contested battlespace.

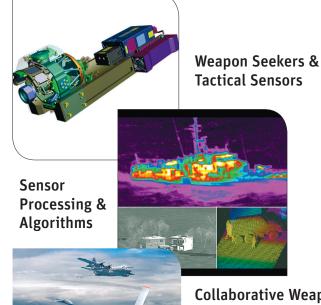
Impact

Advanced Weapon Technologies: Development of novel photon detector and ladar technology is leveraging access to international co-developments.

Technical Intelligence: DST VIRSuite scene generation software has been adopted by our international partners as an integral part of joint threat assessments.

Future War Fighting Concepts: Collaborative weapon concepts and autonomous tactical response options are being developed for future complex and high-tech conflicts.

Interoperability and EM Protection: Accurate Target Location Error analysis has been undertaken for RAAF precision guided weapons, enabling F/A-18A integration with coalition forces. EM studies have ensured safe and non-degraded operation of JDAM-ER, ASRAAM and RF systems being procured under projects AIR6000, SEA1448, AIR7000 and SEA 4000 and contributed to high power microwave directed energy capability development under project JP154.



Electromagnetic Effects Characterisation & Control

Collaborative Weapons & Autonomous Response



S&T Excellence

Three year publication record

39 DST Technical Reports

19 DST Client Reports

21 Journal Papers

16 Conference Papers

3 Patents

Peer Recognition

- · ARC Reviewer
- · Adjunct Professor
- 4 PhD Examiners
- 5 Journal Reviewers
- Chair TTCP WPN Group
- 3 International Conference Committee Members

Awards

- 2 MBDA (UK) Innovation Awards 2013, 2015
- UK MOD Chief S&T Advisor Commendation 2014
- TTCP Award 2014
- 2 DST Group Achievement Awards 2015
- 2 Chief of Air Force Commendations 2016
- 2 Civilian Operation Service medals 2013, 2015
- Australia Day Medallion 2016, 2017
- DST Group Award for Outstanding Communication of S&T 2016
- CDS Gold Commendation 2015

PARTNERSHIPS & OUTREACH

Universities

University of Adelaide University of Western Sydney University of NSW Monash University RMIT University Australian National University Deakin University

Industry

Fraunhofer IZM BAE Systems Teledyne Defence Australia

Government

ANSTO Govt. of South Australia

International

TTTCP WPN Group USN NAVAIR DRDC (CA) MoD E3, Dstl (UK) USAF AFRL, AFSEO BAE Systems, MBDA, AWC (UK) Kongsberg Milan Politechnic JAEA (Japan) FSTD (Singapore)



Energetic Systems and Effects

Goal

To conduct fundamental and applied scientific research in Energetics (materials, systems, effects) in collaboration with academia, industry and international partners to deliver high-impact outcomes for Defence and National Security.

Impact

Enabling Future Weapons: Advanced research and development of next-generation propulsion, explosives and warhead technologies in collaboration with international partners is enabling game-changing Defence capabilities.

Countering Current and Emerging Threats: As Australia's primary source of deep expertise in energetic systems (including IEDs and flares), the MSTC is responsive to time critical Defence and National Security requirements.

Operational and Intel Advice: Specialist research and analysis provided to Defence and Intelligence agencies enables informed decisions on explosive ordnance to protect the warfighter from current and evolving threats.

Safe and Effective Explosive Ordnance: In-house knowledge and research is ensuring the safety and effectiveness of frontline ADF weapon systems and has saved Defence over \$50m in acquisitions and averted fatal risks to personnel.



S&T Excellence

Three year publication record

29 DST Research Reports

62 DST Client Reports

17 Journal Publications

62 Conference Papers

2 Book Chapters

Peer Recognition

- 3 Associate Professor and Lecturer Positions at Flinders University
- · Adjunct Professor at University of SA
- 3 PhD Supervisors
- 6 Journal Reviewers
- TTCP WPN Group 2 TP National Leads
- Fellow Royal Australian Chemical Institute
- Membership of American Chemical Society, Royal Society of Chemistry and International Pyrotechnics Society

Awards

- PM's Award for Excellence 2013
- CTTSO 10 Years Outstanding Service Award 2016
- TTCP Awards 2012, 2016
- Chief of Air Force Commendation 2016
- AFP Commissioner Award 2016
- · CDS Gold Commendation 2015
- Australia Day Medallion 2013
- DST Group Achievement Award in Technical Excellence and Outstanding Corporate Contribution 2016

PARTNERSHIPS & OUTREACH

Universities

Flinders University University of Victoria Australian National University, University of NSW Canberra University of Queensland University of Adelaide

Industry

Thales Australia Chemring DefendTex Frazer-Nash

Government

AFP Attorney General's Department

International

TTCP WPN Group
USAF AFRL
ARDEC (US)
MBDA & DOSG (UK)
CTTSO (US)
University of Manchester







National Security and ISR Division



Science and Technology for Safeguarding Australia

Intelligence Analytics

Goal

Intelligence Analytics adds value to Australia's defence and national security by improving the situational awareness of Australian intelligence analysts.

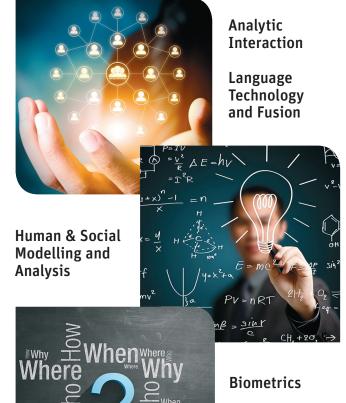
Impact

Biometrics: Biometrics has informed the procurement strategy for the Australian Passports Office through studies into Facial Recognition Algorithms, developed eFace technology, and assisted with the National Biometrics Matching Capability with the Australian Intelligence Community.

Information Fusion: Information fusion capabilities are sought after by allied nations. The MSTC is engaged in Five Eye collaboration through various international programs (TTCP and Squaredance).

Visual Analytics: Development of analytic software to mitigate procurement risk of DEF100 by refining requirements for GEOINT analysts.

Social Media Exploitation: Providing intelligence value from Open Source INT for Army Situational Understanding and NS clients - includes human domain understanding, information dissemination and influential actors.



S&T Excellence

Three year publication record 14 DST Group Technical Reports

24 DST Group Client Reports

10 Journal Publications

20 Conference Papers

3 Book Chapters

Peer Recognition

- Executive Chair TTCP C3I Group
- TTCP CUESC Australian Event Lead
- 11 Adjunct University Appointments
- 2 ARC Assessors
- 4 PhD Supervisors
- 13 Professional Memberships

Awards

- 3 Australian Operational Service Medals with 4 clasps 2014
- NATO Medal with clasp 2009, 2012
- AIC Team Award 2016
- DST Group SRI Fellowship (2015-18)
- IEEE Harry Rowe Mimno Paper Award 2015

Multi— Intelligence Analytics

PARTNERSHIPS & OUTREACH

Universities

Flinders University
University of South Australia
University of NSW
University of Adelaide
University of Melbourne
Swinburne University
Queensland University of Technology
Victoria University

Industry

Swordfish Cognitec, NEC, SAFRAN, 3M, Aware, Westbourne, Raytheon, CSRA, appen, LDC, Data to Decisions CRC, Consilium, Source Forge

Government

Australian Intelligence Community CSIRO, DATA 61
Government of South Australia

International

TTCP C3I Group
TTCP Contested Urban Environment Strategic
Challenge (CUESC)
Squaredance
DARPA, ONR, ARL (US)
US Intelligence Community



Information Integration

Goal

To develop and demonstrate advanced integrated intelligence, surveillance and reconnaissance (ISR) capabilities supporting Defence decision superiority.

Impact

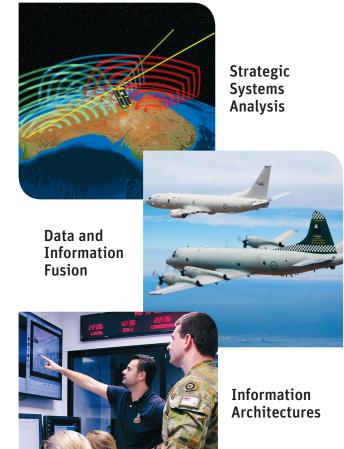
Strategic ISR Systems Analysis: Informing the integration of new AIR 7000 ISR capabilities into the Defence enterprise.

ELIIXAR: The **E**volutionary **L**ayered **I**ntegrated **I**SR e**X**emplar **AR**chitecture is guiding the DGS-AUS(I) ISR exploitation environment for Air Force, and informing the acquisition methodology for JP 2096 for CIO Group.

SERVAL: A DST pilot project providing cost-effective, high quality geospatial imagery from commercial satellites to users across Defence.

Multi-sensor Tracking: DST Group advanced algorithms underpin the ISR capabilities of the Jindalee Operational Radar Network and the Wedgetail airborne early warning and control aircraft.

Small Satellite Missions: Biarri and Buccaneer are positioning Defence to exploit responsive, low-cost spacebased capabilities.



S&T Excellence

Three year publication record

4 DST Technical reports

25 DST client reports

23 Journal publications

32 Conference Papers

Peer Recognition

- 3 Adjunct university appointments
- 2 ARC assessors
- 3 PhD supervisors
- · 2 PhD examiners
- 5 journal reviewers
- 2 IEEE Journal Associate Editors
- 1 IEEE AES Board of Governors member
- TTCP ISTAR Group TP1 chair

Awards

- DST Group awards for outstanding contribution to Defence outcomes 2014 and 2015
- DST Group awards for science excellence 2013 and 2015
- TTCP award for multi-Sensor Integration 2011
- 5 Best Paper awards at recent Fusion conferences

PARTNERSHIPS & OUTREACH

Universities

University of Queensland
University of South Australia
RMIT University
University of Melbourne
Monash University
University of New South Wales (Sydney and Canberra)
Sydney University, Western Sydney University
Australian National University

Industry

Boeing Defence Australia
BAE Systems, Price Waterhouse Coopers
Agent Oriented Software
Bayesian Intel
Lockheed Martin
Northrop-Grumman
Airbus Defence and Space

International

TTCP ISTAR Group
Dstl (UK)
FGAN (Germany)
Square Dance
Responsive Space MOU (10 Nations)
US Naval Postgraduate School



Intelligence Systems

Goal

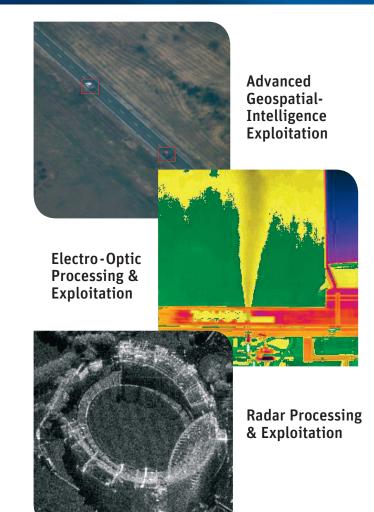
Research, develop and transition advanced Geospatial Intelligence (GEOINT), imagery Measurement and Signatures Intelligence (MASINT), and automated GEOINT processing to enhance Australia's Intelligence, Surveillance & Reconnaissance (ISR) capabilities

Impact

Advanced Sensing: Development of advanced sensing techniques for difficult environments using hyper-spectral and imaging radar. Demonstrated capabilities in airborne trials, provided advice to ADF for ISR and equipment signatures.

MASINT Techniques: New persistent techniques demonstrated leading to operational evaluation, new temporal techniques trialed and demonstrated with international partners.

Automated GEOINT Processing: New techniques and processing capabilities transitioned to limited operations, demonstrated new real-time target detection capabilities for video & radar maritime ship classifier, investigated new automated GEOINT processing architectures for technical risk reduction.



S&T Excellence

Three year publication record

7 DST Technical Reports2 Journal Publications39 Conference Papers

Peer Recognition

- 1 ARC and 1 NASA reviewer
- 4 PhD examiners, 4 PhD Supervisors
- 2 PhD Awards, 2 Visiting Research Fellows
- 10 journal reviewers
- TTCP Contested Urban Environment (CUE) Lead
- TTCP ISTAR Group Australian Lead

Awards

- 3 Square Dance Arnold Awards 2011, 2013, 2014
- Square Dance Pranke Award 2012
- 2 TTCP Awards
- 1 Defence Meritorious Unit Citation Award
- 1 Defence Support Services Silver Commendation 2011
- 1 NATO Award 2014
- US Defence National Intelligence Citation 2012
- DST Group Awards 2011, 2012, 2014, 2015

PARTNERSHIPS & OUTREACH

Universities

University of Adelaide University of NSW University of Technology Sydney Swinburne University Data to Decisions (D2D) CRC

Industry

Rheinmetall BAE Systems Hawker Pacific Lockheed Martin Swordfish SAAB Systems VCorp

Government

Bureau Of Meteorology Department of Foreign Affairs & Trade

International

Square Dance TTCP ISTAR Group Dstl (UK) NATO STO US Air Force, Navy and Army research laboratories



Surveillance and Reconnaissance Systems

Goal

To provide Australia with a surveillance and reconnaissance edge by exploiting active and passive radar technologies, advanced signal processing, and radar signature prediction, measurement & exploitation.

Impact

Wedgetail: Provided critical technical advice and solutions to enable the Wedgetail system to provide the world's best AEW&C capability. Providing ongoing advice on capability edge sustainment.

Signature Management: Provided critical advice on the control and management of the radar signatures of ADF weapon systems, including time critical advice to support specific operational objectives.

Radar System Evaluation: Conducted research and provided advice to enable the ADF to make appropriate decisions regarding selection, use and expected performance of radar systems.

Passive Coherent Location: Demonstrated the operational effectiveness of passive coherent location technology to the ADO.



S&T Excellence

Three year publication record

25 DST Technical Reports22 DST Client Reports60 Journal Publications138 Conference Papers

Peer Recognition

- 1 Adjunct university appointment
- 3 PhD supervisors
- 1 IEEE AES Board of Governors member
- · 4 journal reviewers
- TTCP ISTAR Group Technical Panel Australian Lead
- · NATO SET Panel Australian Lead

Awards

- Ministers Award for Defence Science 2011 (C Anderson)
- Gold award for excellence in public sector management 2013
- DST Group Award for Outstanding Contribution to Defence Outcomes 2014
- DST Group Award for Science and Engineering Excellence 2016
- Best Paper Awards at International Radar Conference 2014, 2015

PARTNERSHIPS & OUTREACH

Universities

University of Adelaide University of South Australia University of Melbourne RMIT University University of Queensland Curtin University Macquarie University University of NSW Canberra

Industry

Northrop Grumman
Boeing Defence Systems
CEA Technologies
Daintree Systems
Rheinmetall Defence
Solinnov
Raytheon Teledyne Australia

International

TTCP ISTAR Group NATO SET Panel USN NAVAIR, ONR, NRL Fraunhofer FHR (Germany) Dstl, RAF (UK) University College London Arizona State University University of Dayton University of Pennsylvania, University of Pisa Colorado State University



High Frequency Radar

Goal

Conduct R&D into high-frequency over-the-horizon radar to enhance and sustain Australia's wide-area air and surface vessel surveillance capability.

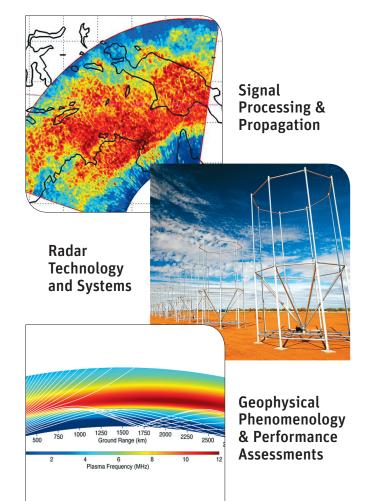
Impact

Operations: JORN daily support; R&D transitioned to capability with extended coverage, improved detection sensitivity, clutter and interference rejection, EW suite.

Sustainment: JORN component replacement integrity; development of specialised equipment design options.

Acquisition: Capability options; technical and industry workforce risk reduction through the JORN Priority Industry Capability (PIC) Program; system design and assessment; modelling; experimentation and demonstration.

Future Proofing: New radar design and high-fidelity instrumentation aiming for significant detection sensitivity and persistence improvement.



S&T Excellence

Three year publication record

4 DST Technical Reports **12** Journal Publications

20 Conference Papers

Peer Recognition

- 1 ARC Assessor
- 3 Adjunct Lecturers University of Adelaide
- 1 Adjunct Research Fellow University of Adelaide
- 1 IEEE Fellow
- 1 IEEE Senior Member
- 1 IEEE Associate Editor

Awards

- US INT Community Awards 2009, 2016
- 2 DST Group S&T Excellence Awards 2014
- DST Group Jindalee Pioneer Award 2011

PARTNERSHIPS & OUTREACH

UniversitiesUniversity of Adelaide

Industry Lockheed Martin (Aust) BAE Systems **Government**Bureau of Meteorology

International

US ROTHR Program Office
US Intelligence Community
US Naval Research Laboratory
US Air Force Research Laboratory
MIT Lincoln Laboratory





Major Science and Technology Capabilities (MSTCs)

Each MSTC comprises people, infrastructure, S&T know-how and partner relationships in a combination of a science and defence domain. The science component comprises the specialist knowledge, skills and experience of staff in the domain, as well as infrastructure and partnering. The defence component is the context in which our specialist knowledge, skills and experience have impact, including the particular physical aspect or operational context.

Responsible for corporate duties in order to shape strategic direction Defence and external partners.

Science Strategy and Program **Division** Develops science policy, formulates Defence S&T and strategic research programs, and oversees resource investment into S&T capabilities.

Sonar Technology and Systems



Science Partnerships and Engagement **Division** Coordinates and develops interactions with industry, academia, overseas agencies and other Australian government agencies. Promotes defence science in the education and wider Australian communities.



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



Maritime Division (MD)

enhance the operational performance and survivability of defence platforms in the maritime domain.

Land Division (LD) Provides support applying expertise in human sciences. vehicle and systems sciences, and

to grow the ADF's undersea warfare capability.

Conducts leading research and development in undersea acoustic sensors and systems and manoeuvring performance of ships and submarines.

Acoustic Signature Management Delivers S&T solutions to manage the acoustic signature of defence platforms; and the hydrodynamic

Non Acoustic Signature Management Undertake research in materials science and technology to enhance the survivability, operational capability, seakeeping and cost of ownership of ADF platforms.

Maritime Autonomy Leads research into autonomous and unmanned systems to enhance ADF capability in maritime surveillance, mine countermeasures and rapid environmental assessment.

Undersea Command and Control Provides the ADO with scientific and technical expertise to enhance the RAN's undersea warfare capability and decision making.

Maritime Platform Performance Undertakes research in platform performance of materials. structures and systems to enhance the capability, survivability and safety of RAN vessels.

and solutions for ADF personnel by chemical and biological warfare.

Land Human Systems

Develops, sustains and applies the broad cross-section of human science skills in support of ADF land operations.

Land Vehicles and Systems Conducts research in vehicle systems management, armour and protection, logistics and integrated support systems.

Chemical and Biological Defence Research and development of defence against chemical, biological and radiation (CBR) threats.

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 Effectiveness Supports Defence outcomes in

capability, efficiency and safety by providing advice and solutions where humans and air platforms or systems interact.

Aircraft Performance and Survivability Conducts performance and survivability modelling and experimentation for flight, propulsion, signatures and stores carriage and clearances.

Aircraft Health and Sustainment Supports aircraft health management systems and technologies, engine and fuel integrity, and aerospace systems sustainment analysis.

Airframe Technology and Safety Works to ensure aircraft safety and availability, reduce fleet cost of ownership and advises on acquisition projects.

Aircraft Structures Provides safety-critical aircraft structural integrity and airworthiness advice and solutions to the ADO.

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 develop and apply analytical methods, techniques and tools to inform decisions impacting: 1. Aerospace Capability, 2. Land Capability and 3. Maritime Capability. This encompasses specification, procurement, command and control, underpinning technologies, force structure and training, and their contribution to operational effectiveness.

Supports joint capability issues, including through the DST Group operations support centre by immersion and experimentation with warfighters.

Joint Capability Analysis

Strategic Capability Analysis Informs strategic policy and capability decisions by applying analysis, concept development. risk assessment and technology forecasting.

Decision Sciences Enhances military decision-making at individual, team and organisational levels in terms of intent, capabilities, awareness and control including human and machine perspectives, and their integration.



Cyber and Electronic Warfare Division (CEWD) Provides expert advice and technology solutions in the cyber

domain and electronic warfare

Cyber Assurance and Operations **Cyber Sensing and Shaping**

Supports enhanced performance Develops techniques for accessing. in the presence of threats and characterising and shaping unauthorised activities on communication networks to computer resources. enable cyber operations.

Assured Communications

Provides solutions for robust communications in contested. complex and dynamic environments.

Weapons Systems Technology

Applies S&T of sensors, processing

and electromagnetic interactions

Systemic Protection and Effects Analyses and supports critical cyber physical systems, with respect to systemic electronic attack.

Energetic Systems and Effects

Conducts research into energetic

materials, weapons and explosive

and National Security capabilities

ordnance to enable new Defence

and the safety of ADF assets.

Spectrum Sensing and Shaping Supports enhanced situational awareness in complex radio frequency environments, and defeating the future networked EW, cyber and kinetic threats.

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 weapon and combat systems for Defence.

Intelligence Analytics

Develops situational awareness capabilities for intelligence analysts and conducts domainspecific research into human, open-source and all-source analysis techniques.

Tactical Systems Integration

Conducts research into tactical-

integration and interoperability;

decision superiority for the ADF.

automation; and processing, to

information: architectures;

achieve distributed tactical

of weapon system performance and end-to-end tactical system effectiveness.

Tactical Systems Performance

Assessment Conducts analysis

to weapons and tactical systems to enhance the ADF's warfighting capability.

Intelligence Systems

Surveillance and Reconnaissance national security needs.

High Frequency Radar Enhances long-range over-thehorizon radar as part of the national intelligence, surveillance and reconnaissance system. to national security.

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

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

Information Integration Supports the integration and application of intelligence, surveillance and reconnaissance systems.

Develops intelligence systems for geospatial intelligence and measurement and signature intelligence, and imagery-based capabilities.

Systems Conducts research into surveillance and reconnaissance systems and assesses their application to defence and

Science Excellence

Defence has defined Science Excellence in these terms:

"Science and technology excellence within Defence is demonstrated by the highest international standards for scientific and technological innovation, rigour, original contribution and influence, whilst solving the most challenging and valued problems."

The principles and characteristics of science and technology excellence have been defined to incorporate three nested layers, representing the individual researcher, the MSTC and the organisation as a whole. Success in achieving science and technology excellence will be governed by eight practical activities:



- **1.** MSTCs have external quality review once every 4 years
- **2.** Every person in an MSTC will have a learning and development plan
- **3.** MSTC staff actively collaborate with internationally recognised research institutions
- **4.** The MSTC will be actively involved with defence R&D organisations
- **5.** MSTC staff members will present and test ideas with peers through conferences, publications, colloquia and symposiums
- **6.** Every STC in an MSTC will have peer reviewed publications in high quality journals or conference proceedings
- **7.** The MSTC delivers value through its transition path from S&T to a defence capability
- **8.** The MSTC will shape and develop defence S&T capability and build the talent pool for the future through engagement with academia



Principles and Characteristics of Science & Technology excellence

Characteristics	
Our S&T achieves high quality, high value Defence and national security outcomes	
We undergo external quality reviews by independent experts at regular intervals Staff contribute to symposia, colloquium, conferences, teaching/lecturing	
We actively collaborate with internationally recognised research institutions, defence R&D organisations, and actively contribute to conferences, publications and symposia	
Every person has a learning and development plan	
Staff publish unclassified work in leading refereed journals. Staff publish classified work in client or technical reports	
Staff are active members of collaborations with universities	
Staff are active members of collaborations with industry	
We undertake reviews of our capability and outcomes	

Partnerships

DST Group accesses and leverages world-leading science, technology, knowledge and innovation by collaborating with industry, academia and international agencies. Working closely with these partners ensures quality advice and innovative solutions for Defence and national security.

Science and technology partnerships also provide pathways for Defence innovations to be transferred to industry for commercialisation and the development of future capability.

DST Group has long-term Strategic Alliances with 14 defence primes and publicly-funded research agencies. These alliances are in addition to a number of individual collaboration agreements with technology companies and small business enterprises.

The Defence Science Partnerships framework has been developed for universities and Defence to conduct joint research under a standard agreement which provides cost efficiencies and time savings. More than 30 Australian universities are now partnering with **DST Group** under this framework, providing a larger research network to support Defence outcomes.

DST Group forms partnerships with defence research organisations overseas to access international capabilities that would otherwise not be available to the Australian Defence Force. The principal multi-lateral science and technology relationship is with the United States, United Kingdom, Canada and New Zealand under the Technical Cooperation Program. Joint research in niche capabilities is also undertaken with the Netherlands, Sweden, France, Japan, South Korea and Singapore.

DST Group is leading the \$730 million Next Generation Technologies Fund which focuses on developing future gamechanging capabilities in collaboration with industry and academia.



Doing Business with DST Group

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Science and Technology for Safeguarding Australia



Defence values cultural diversity.