



Australian  
National  
University



Australian Government  
Department of Defence  
Science and Technology



# 4TH MODELLING COMPLEX WARFIGHTING SYMPOSIUM

## PROGRAM

Wednesday 11 - Thursday 12 December 2019

The Australian National University, Canberra

# INTRODUCTION

## Modelling Complex Warfighting

The Defence Science and Technology (DST) Group sponsors research focused on priority areas for future Defence capabilities. One such area is the Modelling Complex Warfighting (MCW) Strategic Research Initiative (SRI), launched in 2017 with an initial five-year horizon.

MCW aims to revolutionise how DST undertakes operations analysis. We seek to provide warfighting advantage to the ADF through a superior ability to analyse:

- > the complex interactions of geopolitical, social, technological, economic and cultural factors that characterise the operating environment; and
- > the effectiveness of ADF response options within that operating environment, for both the conduct of current operations, and the design of the future Defence Force.

These ADF response options are often required under high uncertainty, and without assumptions of predictability or system stability. MCW is developing the transformational operational analysis capability to **assure** and **accelerate** decision-making by Australian Defence and Government on operations, future capabilities and investment.

## MCW Symposium

The biannual MCW Symposium is the primary means through which MCW's multi-disciplinary research community interacts across project and discipline boundaries. The symposium brings DST researchers and academic partners together with Defence stakeholders to align MCW research objectives with Defence requirements. In addition to providing a forum to share research objectives and results, these symposia provide opportunities for new academic partners to join the growing MCW research community.

The 4th MCW Symposium is structured around MCW's flagship projects:

- > Modelling in the *Grey Zone*
- > AI and advanced analytics for decision-making
- > Agile whole of force analysis.

## MCW Symposium Partners

The 4th MCW Symposium is conducted in partnership with The Australian National University, specifically, the Strategic and Defence Studies Centre (SDSC) and the Research School of Management.

**SDSC**, founded in 1966, is Australia's oldest and largest academic centre dedicated to research and education relating to the use of armed force in its political context. Its activities are concentrated within three inter-disciplinary research clusters: Australian Defence and Strategic Policy, Military Studies, and Asia-Pacific Security.

**The Research School of Management** develops responsible and resilient leaders with knowledge, skills and capabilities needed to make a difference to organisations and society. Its unique approach to management education is informed by relevant, important and impactful research that addresses the challenges of managing in a complex, rapidly changing and uncertain world.

# PROGRAM

## DAY 1 – Wednesday 11 December

8.30am	<b>Registration</b> - Atrium, Hedley Bull Building 130, ANU
9am	<b>Welcome</b> <b>Dr Garth Pratten, Strategic and Defence Studies Centre (SDSC), ANU</b>
9.15am	<b>Overview of Symposium</b> <b>Dr Tim McKay, Lead, Complex Warfighting Strategic Research Investment program (MCW SRI), Defence Science and Technology Group (DST), Department of Defence</b>
9.30am	<b>MCW 2.0 Overview</b> <b>Dr Renée Kidson, MCW Research Coherence</b>
9.45am	<b>Project Lead Introductions</b> <b>Dr Yi Yue, Dr Paul Gaertner, Dr Simon Ellis-Steinborner, DST</b>
10am	<b>1st Plenary Keynote Address: Defence Science and Technology Strategy</b> <b>Dr Lynn Booth, Chief of the Joint and Operations Analysis Division, DST</b>
10.30am	<b>Morning tea</b> - Atrium
11am-12pm	<b>Parallel Session Streams (HB2, HB1, and HB3)</b>
	<b>Artificial Intelligence and Advanced Analytics for Decision-Making: HB2</b> <b>Artificial Intelligence (AI) and Autonomy</b>
11am	> AI Enabled Wargaming Overview Dr Clint Heinze, DST
	> Autonomous Analyst Overview Dr Darryn Reid, DST
11.20am	> Jericho and Enabled Decision-Making GPCAPT Lyle Holt, Jericho, RAAF
11.40am	> AI for Analysis Dr Deb Fish, DSTL, UK
	<b>Modelling in the Grey Zone: HB1</b> <b>Modelling Complex Human Systems</b>
11am	> Using Design Artefacts to Understand Complex Human Systems Prof Debi Ashendon, Deakin University
11.20am	> Grey Zone vs Hybrid Warfare Dr Don Lowe, DST
11.40am	> Modelling Representation Biases A/Prof Amy Perfors, University of Melbourne, and Dr Nicholas Fay, The University of Western Australia
	<b>Agile Whole of Force Analysis: HB3</b> <b>Mathematical Modelling</b>
11am	> Defence Portfolio Optimization: An Overview Dr Kyle Harrison, UNSW Canberra
11.20am	> Modelling Utility, Aggregation and Multi-Objective Sequential Decision-Making for Whole of Force Design Dr Thang Cao, DST, A/Prof Richard Dazeley, and Dr Vicky Mak, Deakin University
11.40am	> Modelling and Simulation that Supports UK Strategic Force Development Dr Cayt Rowe, DST

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## DAY 1 – Wednesday 11 December

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12pm	<b>2nd Plenary Keynote Address: Countering Foreign Interference</b> <b>Mr Cameron Ashe, A/National Counter Foreign Interference Coordinator, Department of Home Affairs</b>
12.30pm	<b>Lunch</b> - Atrium
1.30pm	<b>3rd Plenary Keynote Address: Extending the Intellectual Edge with Artificial Intelligence</b> <b>MAJGEN Mick Ryan, Commander Australian Defence College</b>
2-3pm	<b>Parallel Session Streams (HB2, HB1, and HB3)</b>
	<b>Artificial Intelligence and Advanced Analytics for Decision-Making: HB2 Assured and Social AI</b>
2pm	> AI Research in the University of Melbourne Prof Adrian Pearce, University of Melbourne
2.20pm	> AI Ethics Framework Dr Emma Schleiger, Data61/CSIRO
2.40pm	> Apprenticeship Bootstrapping for Swarm Shepherding Prof Hussein Abbass, UNSW
	<b>Modelling in the Grey Zone: HB1 Influence Concepts and Measurements</b>
2pm	> The Role of Small Group Processes in Grey Zone Conflicts Dr David Kernot, DST
2.20pm	> Analysis Concepts to Support the Delivery of Effects in the Grey Zone: Insights from the UK Influence Programme Mr David Lowe, DSTL, UK
2.40pm	> Social Networks Analysis A/Prof Robert Ackland, ANU, and Dr Lewis Mitchell, University of Adelaide
	<b>Agile Whole of Force Analysis: HB3 Cross-Disciplinary Approaches</b>
2pm	> Modelling C2 in Multi-Domain Operations: A Cyber Use-Case Dr Alex Kalloniatis
2.20pm	> Trading Card Games, Deck Construction and Portfolio Effectiveness Dr Mathew Zuparic, DST
2.40pm	> Exploring Project Benefit Management in Defence Dr Ofer Zwikael, Prof Giles Hirst, Dr Dale MacKrell, ANU; Dr Ivan Garanovich, and Dr Terence Weir, DST
3pm	<b>Afternoon tea</b> - Atrium

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## DAY 1 – Wednesday 11 December

### 3.30-5pm **Parallel Session Streams (HB2, HB1, and HB3)**

#### **Artificial Intelligence and Advanced Analytics for Decision-Making: HB2 Autonomous Analyst**

- 3.30pm > Narrative Visualisation of Simulations for Force Design  
Prof Bruce Thomas, University of South Australia
- 3.50pm > Using Entropic Measures of Surprise Potentials for Decision-Making  
Prof Rajesh Vasa, Deakin University
- 4.10pm > Augmented Analytics Enabled OA  
Dr Sanat Bista, DST
- 4.30pm > Intelligent Analyst Assistant  
Dr Antonio Giardina, Deakin University
- 4.50pm > Towards an Autonomous Analyst  
Prof Ted Goranson, Griffith University

#### **Modelling in the Grey Zone: HB1 Influence Concepts and Measurements**

- 3.30pm > Modelling Human Complexity: Impacts for Grey Zone  
Dr Lucia Falzon, DST Fellow
- 3.50pm > Agent-Based Modelling for Understanding Grey Zone Conflict  
Dr Aaron Frank, RAND, USA
- 4.10pm > Technological Disruptions and the Grey Spaces Between War and Peace  
Dr Adam Henschke, ANU
- 4.30pm > Cultural Aspects of Radicalisation  
Prof Claire Smith, Flinders University, and Dr Lucy Resnyansky, DST
- 4.50pm > Contrasting Theories of Normative Influence  
Dr Piers Howe, University of Melbourne

#### **Agile Whole of Force Analysis: HB3 Analytical Methods**

- 3.30pm > Smart OA via the Design and Analysis of Simulation Experiments  
Dr Andrew Gill, DST
- 3.50pm > Knowledge Synthesis for the Autonomous Analyst  
Dr Robert Niven, UNSW Canberra, Dr Peter Massingham, University of Wollongong,  
and Ms Jane Holloway, DST
- 4.10pm > A Review to Scope the Capability for Whole of Force Simulation  
Dr Ralph Gailis, DST
- 4.30pm > State-of-the-Art in Equation-Based Unified Warfighting Force-on-Force Modelling  
Dr Alex Kalloniatis, DST
- > Game Theory in a Model of Decision Advantage and Combat Dynamics  
A/Prof Tansu Alpcan, University of Melbourne

### 5.10pm **Close**

### 5.30pm-7.30pm **Networking Event - Atrium**

**Speaker: Honorary Professor Richard Brabin-Smith, SDSC, ANU**

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## DAY 2 – Thursday 12 December

8.30am	<b>Registration</b> - Atrium
9am	<b>4th Plenary Keynote Address - Modelling Influence: Potentium and the Onyx Wargame</b> (MORS Livestream) <b>Ms Kendy Hau, Director Joint Influence Activities, Joint Capabilities Group, and Mr Peter Williams, DST</b>
9.30am-11am	<b>Parallel Session Streams (HB2, HB1, and HB3)</b>
	<b>Artificial Intelligence and Advanced Analytics for Decision-Making: HB2</b> <b>Artificial Intelligence</b>
9.30am	> Argumentation and Narrative Generation for Effective Decision Analysis A/Prof Richard Dazeley, Deakin University
10am	> AI and Ethics in Defence WGCDR Michael Gan, RAAF
10.20am	> Bayesian Optimisation and Design of Experiments Prof Svetha Venkatesh, Deakin University
10.40am	> Multi-Domain Battle Management using Reinforcement Learning to Achieve Decision Superiority Mr Amool Prasad, Northrup Grumman
	<b>Modelling in the Grey Zone: HB1</b> <b>Grey Zone Analysis</b> (MORS Livestream)
9.30am	> Computational Social Sciences Research in the Context of Grey Zone Activities Prof Yoshihisa Kashima, University of Melbourne
10am	> Potentium Analytical Methods Prof Michael Webb, University of Adelaide, and Mr Mick Cook, UNSW
10.20am	> Mapping Democratic Insecurities and Information Warfare Dr Tim Legrand, University of Adelaide
10.40am	> Social Resilience Prof Paul Arbon and Prof Rick Nunes-Vaz, Flinders University
	<b>Agile Whole of Force Analysis: HB3</b> <b>Strategic Uncertainty</b>
9.30am	> Transdisciplinary Approaches to Managing Unknowns Prof Gabriele Bammer, ANU
10am	> Unknowns, Uncertainty, Ignorance and Ambiguity in Defence Strategic Decision-Making Ms Jane Holloway, DST
10.20am	> Force Design Wargames Mr Marcus Tregenza, DST
10.40am	> Interactive, Real-time Reinforcement Learning Combat Simulation Training on Any Device Dr Theodor Wyeld, Australian Catholic University



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11am	<b>Morning tea</b> - Atrium
11.30am-12.30pm	<b>Parallel Session Streams (HB2, HB1, and HB3)</b>
	<b>Artificial Intelligence and Advanced Analytics for Decision-Making: HB2 AI and Wargaming</b>
11.30am	> AI for Wargaming Dr Glenn Moy, and Mr Martin Wong, DST
11.50am	> AI in Games Dr Melissa Rogerson, University of Melbourne
12.10pm	> Evolutionary Computation and Strategy Dr Martin Masek, Edith Cowan University
	<b>Modelling in the Grey Zone: HB1 Responding to Grey Zone Activity</b>
11.30am	> Influence Dynamics and Consensus A/Prof Markus Brede, University of Southampton, and Alan Turing Institute, UK
11.50am	> Lanchester Modelling of War Amongst The People Dr Sergiy Shelyag, Deakin University
12.10pm	> Modelling the Impact of Non-Military Agencies in the Conflict Environment Dr Tim McLennan-Smith, UNSW Canberra
	<b>Agile Whole of Force Analysis: HB3 Workshop</b>
11.30am	> Connecting the Dots and Relationships: Developing Stakeholder Relationship Prof Giles Hirst, ANU
12.30pm	<b>Lunch</b> - Atrium
1.20pm	<b>5th Plenary Keynote Address: The Challenge of Strategy and Planning in a World of Continuing Disruption</b> <b>Professor Brendan Sargeant, SDSC, ANU</b>

### WiFi

While on ANU campus, speakers and delegates can connect to wifi using the following details.

Please note, username and password is case sensitive:

**Network name: ANU-Secure**

**Username: ANUVisitor**

**Guest Password: festivus1219**

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## DAY 2 – Thursday 12 December

### 1.50pm-3.30pm **Parallel Session Streams (HB2, HB1, and HB3)**

#### **Artificial Intelligence and Advanced Analytics for Decision-Making: HB2 AI and Modelling**

- 1.50pm > AI in Games  
A/Prof Spike Barlow, UNSW Canberra
- 2.10pm > Advanced Analytics for Military Scenario Development  
Dr Michael Lauren, DTA, New Zealand
- 2.30pm > Modelling Deception  
Mr Lyndon Benke, DST
- 2.50pm > Machine Learning in Real Time Strategy Games  
A/Prof Richard Xu, University of Technology Sydney

#### **Modelling in the Grey Zone: HB1 Measuring Impact**

- 1.50pm > Identification of Trust, the Parameters of Authority, and the Prospective Opportunity Responses  
Dr Maryanne Kelton, and Prof Don DeBats, Flinders University
- 2.10pm > Panel Discussions: Adjusting to A New Operating Environment  
Dr Brandon Pincombe, and Dr Justin Fidock, DST; Ms Anastasia Kapetas, and Mr Lachlan Wilson, NSC Futures Hub, ANU

#### **Agile Whole of Force Analysis: HB3 Workshop**

- 1.50pm > Force Design Methodologies – A Global Update  
Mr Ben Coleman, SDSC, ANU
- 2.10pm > Future of Agile Whole of Force Analysis Theme  
Dr Yi Yue, and Dr Fred Bowden, DST

### 3.30pm **6th Plenary Keynote Address: Everything is Broken**

**Dr Lesley Seebeck, CEO, ANU Cyber Institute**

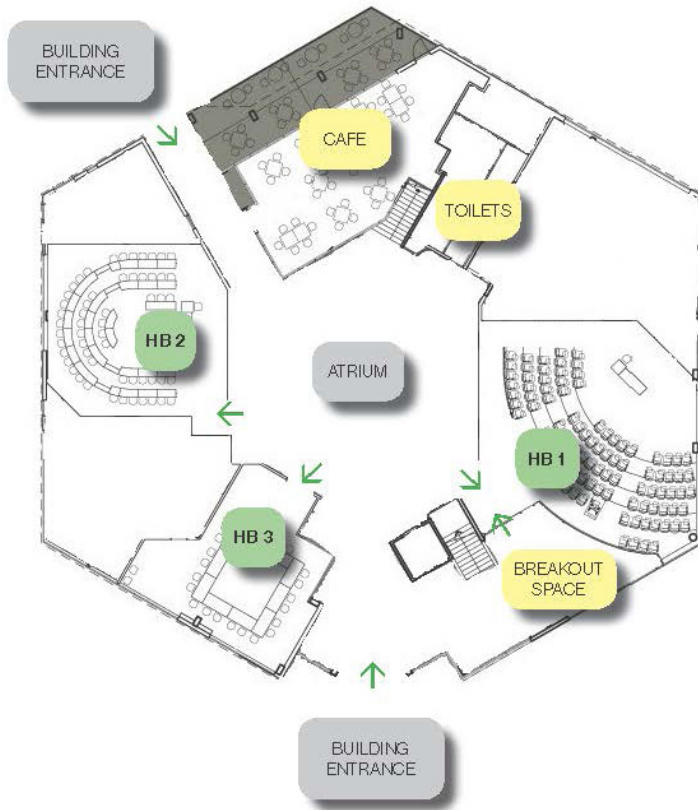
### 4pm **Closing drinks** - Fellows Bar, University House, ANU





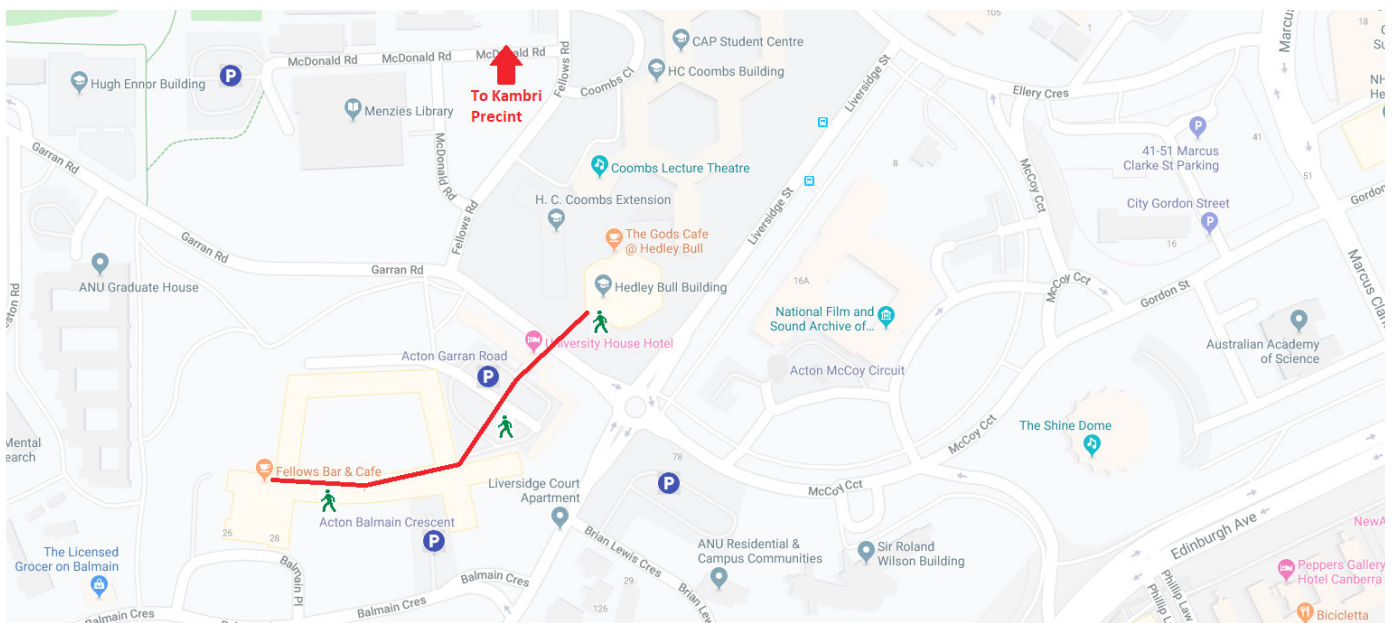
# GENERAL INFORMATION

## Hedley Bull Building 130, ANU



## University House

Closing drinks will be held at Fellows Bar, University House. Walking directions from Hedley Bull Centre to Fellows Bar are indicated on the map above (walk through car park towards rear entrance of University House).



# NOTES

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# CONTACT US

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