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**UNSW**  
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## Emerging Disruptive Technologies Assessment Symposium

Day Two Thursday 16 July 2015

### Speaker Biographies

	Page
<a href="#"><u>Dr Robert Dane (Ocius Technology)</u></a> .....	2
<a href="#"><u>Dr Simon Ng (DSTO)</u></a> .....	2
<a href="#"><u>Prof S. K. Gupta (University of Maryland, USA)</u></a> .....	2
<a href="#"><u>Mr Ashley Searl (BAE Systems Australia)</u></a> .....	3
<a href="#"><u>Dr David Johnson (Australian Centre for Field Robotics, University of Sydney)</u></a> .....	3
<a href="#"><u>Dr Jan Carlo Barca (Monash University)</u></a> .....	4
<a href="#"><u>Prof Saeid Nahavandi (Centre for Intelligent Systems Research, Deakin University)</u></a> .....	4
<a href="#"><u>Prof Roberto Sabtini (RMIT)</u></a> .....	4
<a href="#"><u>Dr Jason Scholz (DSTO)</u></a> .....	5
<a href="#"><u>Dr John Zic (CSIRO)</u></a> .....	6
<a href="#"><u>Mr Andrew Lucas (Agent Oriented Software)</u></a> .....	6
<a href="#"><u>Prof Liz Sonenberg (University of Melbourne)</u></a> .....	7
<a href="#"><u>A/Prof Chee Peng (Centre for Intelligent Systems Research, Deakin University)</u></a> .....	8
<a href="#"><u>Prof Tristan Perez (Queensland University of Technology)</u></a> .....	8
<a href="#"><u>Prof R. E. Burnett (National Defense University, USA)</u></a> .....	9

**09:10 Autonomous Unmanned Surface Vessels (USVs) For Ocean Monitoring and Surveillance  
Dr Robert Dane (Ocius Technology)**

Robert Dane is the founder and CEO of Ocius Technology Ltd. Ocius is a company at the forefront of harnessing the powers of the oceans to drive vessels in a seaworthy way. Ocius has built and sold six commercial 'solarsailor' ferries, developing technologies that have been continuously tested and evolved.

Ocius is now focusing on small unmanned surface vessels (USVs) called 'BlueBottles' for use in oceanography, hydrography, oil and gas and defence. BlueBottles harness the energy of the oceans via a patented rigid opening solarsail and a patented forward rudder mounted wave oscillator to give it superior persistence, performance, power and payload in all conditions.

Ocius and Robert have won a host of international design and innovation awards. The Ocius 'rigid opening sail' has been selected by the Carbon WarRoom and the University College of London to be part of the Shipping Innovation Fast Track (SHIFT) program focusing on the feasibility of 'double digit' fuel saving by harnessing wind in a seaworthy and commercial way initially in bulkers and tankers.

**09:30 Micro-UAV Challenges: Exploring the Solutions and their Implications for Capability  
Dr Simon Ng (DSTO)**

Dr Simon Ng graduated from Monash University in 1998 with a PhD in Engineering Science and undertook a post-doctoral fellowship at CSIRO, working in dielectric characterisation studies at microwave frequencies. He joined DSTO in 2001 as a research scientist supporting military experimentation at the strategic and joint force level.

In 2004, he moved to DSTO in Melbourne, where he led the study into the integration of the unmanned component of the ADF's future maritime patrol and response capability into the wider Defence operational information environment. He became National Lead for TTCP JAS TP4 'Systems Engineering for Defence' in 2011 and also led DSTO S&T support to the development of the Defence Space Situational Awareness capability. In 2013, he was seconded to the University of Melbourne as the Associate Director of the Defence Science Institute, where he worked to build closer relationships between Defence, universities and industry. In 2015, he was appointed Group Leader of DSTO's unmanned aerial systems group.

**10:00 Plenary - Challenge and Opportunities in Human Robot Collaboration  
Prof SK Gupta (University of Maryland) via Skype\***

Dr. Satyandra K. Gupta is a Professor in the Department of Mechanical Engineering and the Institute for Systems Research at the University of Maryland, College Park. He is the Director of the Maryland Robotics Center. Prior to joining the University of Maryland, he was a Research Scientist in the Robotics Institute at Carnegie Mellon University. He served as a program director for the National Robotics Initiative at the National Science Foundation from September 2012 to September 2014.

Dr. Gupta's interest is broadly in the area of automation. He is specifically interested in automation problems arising in Engineering Design, Manufacturing, and Robotics. He is a fellow of the American

Society of Mechanical Engineers (ASME). He has served as an Associate Editor for IEEE Transactions on Automation Science and Engineering, ASME Journal of Computing and Information Science in Engineering, and ASME Journal of Mechanisms and Robotics.

Dr. Gupta has received several honors and awards for his research contributions. Representative examples include: a Young Investigator Award from the Office of Naval Research in 2000, a Robert W. Galvin Outstanding Young Manufacturing Engineer Award from the Society of Manufacturing Engineers in 2001, a CAREER Award from the National Science Foundation in 2001, a Presidential Early Career Award for Scientists and Engineers (PECASE) in 2001, Invention of the Year Award in Physical Science category at the University of Maryland in 2007, Kos Ishii-Toshiba Award from ASME Design for Manufacturing and the Life Cycle Committee in 2011, and Excellence in Research Award from ASME Computers and Information in Engineering Division in 2013. He has also received six best paper awards at conferences.

### **11: 10 Industry Experience in Breaking Down the Barriers of Trust in Unmanned Autonomous Systems**

#### **Mr Ashley Searl (BAE Systems Australia)**

Ashley Searl is the General Manager of BAE Systems Australia Weapons Systems line-of-business.

In this role Ashley is responsible for the overall delivery of a portfolio of development, production and through-life support programs that include the Nulka Active Missile Decoy, ESSM and Autonomous Systems. Weapons Systems employs more than 170 people at several domestic locations with globally recognised skills that have produced some of the world's most successful guided weapons and ship air defence systems.

Ashley has been a part of BAE Systems in the Weapons Systems Line of Business since 1998, undertaking several different roles in the areas of engineering, project and program management. Ashley's principle focus with BAE Systems has been the product design and development of various products which make up the Nulka Active Missile Decoy System.

Ashley began his aerospace engineering career at Aerospace Technologies of Australia (ASTA) in 1993 and has held engineering positions at the Defence Science Technology Organisation (DSTO) and GKN Westland Aerospace in the UK. Ashley holds a Bachelor of Aerospace Engineering from the Royal Melbourne Institute of Technology.

### **11:30 Towards Cognitive Sensor Fusion in Unstructured Environments**

#### **Dr David Johnson (Australian Centre for Field Robotics, University of Sydney)**

Dr David Johnson has been working with radar systems and sensor data since 2001, having qualified as a physicist from Imperial College, London. He began his career with Roke Manor Research Ltd: then Siemens' UK R&D facility and now part of the Chemring group. During his time at Roke Manor, David worked on a number of civil and defence projects relating to radar and avionic systems with a particular focus on small-target detection in clutter. In 2006, David moved to Australia to undertake a PhD at the Australian Centre for Field Robotics (ACFR), part of the ARC Centre for Excellence in Autonomous Systems. Following the completion of his PhD, David was employed within the Rio Tinto Centre for Mine Automation, leading the development of compact radar systems and

algorithms to enable automated terrain reconstruction by unmanned vehicles operating in complex unstructured environments. Since late 2014, David has taken on the task of leading the ACFR's defence research interests, while working with industry, DSTO and some quantum physicists to build his own group in the area of embedded multi-spectral coherent signal processing.

### **11:50 Swarm Intelligence - From Biology to Robots**

#### **Dr Jan Carlo Barca (Monash University)**

Jan Carlo's major research interests are in the areas of swarm robotics, swarm intelligence and distributed sensing. He is currently the Director of Monash Swarm Robotics Laboratory and is involved in a wide range of research projects on swarms of UAVs, climbing robots and swarm intelligence. He has also been involved in several research projects on distributed control of ground moving vehicles. Jan Carlo is an affiliate of the 20YY Warfare Initiative at the Center for a New American Security and collaborates with leading researchers across four continents.

### **12:10 Rapid modelling technique for modelling and simulation of large complex systems**

#### **Prof Saeid Nahavandi (Centre For Intelligent Systems Research, Deakin University)**

Saeid Nahavandi received a Ph.D. from Durham University, U.K. He is an Alfred Deakin Professor, Chair of Engineering, and the Director of the Centre for Intelligent Systems Research at Deakin University, Australia. He has published over 550 papers in various international journals and conferences. His research interests include modeling of complex systems, robotics and haptics.

Professor Nahavandi is the Co-Editor-in-Chief of the IEEE Systems Journal, and Associate Editor of the IEEE/ASME Transactions on Mechatronics. He is a Fellow of Engineers Australia (FIEAust), the Institution of Engineering and Technology (FIET) and Senior member of IEEE (SMIEEE).

### **13:30 Cooperative and Non-Cooperative Decision Making for UAS Detect-and-Avoid: A Novel Unified Approach**

#### **Prof Roberto Sabatini (RMIT)**

Roberto Sabatini is a Professor of Aerospace Engineering and Aviation with more than 25 years of experience in the Aerospace and Defence Industry and in Academia. He is an expert in Avionics, Air Traffic Management (ATM) and Unmanned Aircraft Systems (UAS), with specific hands-on competence in Flight Guidance, Navigation and Control, C4ISR, Aviation Human Factors and Ergonomics (human-machine teaming, cognitive engineering and decision making), and Multi-Sensor Data Fusion for civil and military aerospace applications. During his career, he was responsible for numerous research and flight test programs on airplanes, helicopters and UAS, and he has authored or co-authored more than 250 publications.

Professor Sabatini served several years as a Military Officer (Air Force Lieutenant Colonel), Flight Test Engineer and RDT&E/Acquisition Manager in the Italian Ministry of Defence and in the US Department of Defence. Before joining RMIT University, Professor Sabatini was the Program

Manager of Cranfield University's task-force working to the European Union Clean Sky Joint Technology Initiative for Aeronautics and Air Transport (Co-Principal Investigator and Technical Program Manager of the Systems for Green Operations Integrated Technology Demonstrator – Greener Aircraft Trajectories Under ATM Constraints) and led the research team working to the development of ATM and Avionics Systems compliant with the requirements of SESAR and NextGen.

### **13:50 Towards Machine Plasticity**

#### **Dr Jason Scholz (DSTO)**

Dr Jason Scholz leads research for around fifty science and technology staff in cognitive psychology, decision aids, decision automation/autonomy, and the integration of human and machine decision-making in the Decision Sciences branch across three states. He also chairs an International five-eyes science and technology (Technical Cooperation Program or TTCP) strategic challenge group in Autonomy, and leads the DSTO-wide strategic research initiative in Trusted Autonomous Systems.

He provides scientific leadership through invention, innovation, technology prototypes, risk assessments and advice on new and in-service Command and Control (C2) capabilities to the Department of Defence and National Security organizations to improve C2 for operational and strategic headquarters, national security, joint logistics and preparedness.

Significant recent achievements of the Decision Sciences branch include operational transition of the Vital Planning and Analysis (VIPA) system with significant financial savings for Defence exceeding \$100M, in the transition of C2 technologies, development of a wide range of decision aids to enhance operational situation awareness and planning, psychological instruments for measuring individual cognitive styles in the formative education of Commanders, C2 analysis and development in direct support of Military Operations, and Dr Greg Calbert's 2014 Secretary of Defence fellowship.

Jason holds a Bachelor of Engineering in Electronic Engineering from the University of South Australia a PhD in Electrical Engineering from the University of Adelaide. He has over fifty refereed publications and several patents, covering research in telecommunications, digital signal processing, artificial intelligence and human decision making, all with a unifying theme of "decision and control". In 1994, he was attached to the Information Directorate of the C3I Division of the US Airforce Rome Laboratory in New York. He received an achievement award for the Allied Command & Control Operations and Research Demonstrator (ACCORD) test bed in the TTCP C3I Group. Jason has over 32 years of experience in Defence.

#### **14:10 Experiences with formalising trustworthy behaviours systems**

##### **Dr John Zic (CSIRO)**

John Zic is a principal research scientist at CSIRO and leads the Dependable Systems research team. He is the Standards Australia Chair of Committee IT-038 Cloud Computing, which has actively contributed to the new ISO standards 17788 - Cloud Computing Overview and Vocabulary and 17789 Cloud Computing – Reference Architecture.

Most recently, John has been appointed Vice Chair of IEEE P2301 Working Group on Cloud Profiles, developing guidance for cloud portability and interoperability. Previously, John has participated in the NSW Government Information Security Working Group (March – July 2012) and was an expert evaluator for the EU Framework 7 Call 8 Object 10.4 “Trustworthy ICT” in February 2012.

He has given many invited presentations and keynotes: the inaugural MIT Kerberos and Internet of Trust (MIT-KIT) conference in 2014; the EU FP7 Program “Building International Co-operation” in Brussels (2011); INCO-TRUST workshop in New York (2010); Kerberos Consortium Conferences at MIT (2010 and 2011); the Vanguard/TTI CyberINsecurity Conference in 2010 and was a member of the 11th Joint EU and Australian Science and Technology Cooperation Committee in 2010. He was a member of the Australian Academy of Technological Sciences and Engineering Working Group on Cloud Computing from 2009-2010. Academically, he has published in the area of trustworthy and dependable systems since 1990.

Prior to his current position, John was the Research Director for the Networking Technologies Laboratory for a period of two years, during which time he oversaw the second Centre for Networking Technologies for the Information Economy project (CeNTIE 2). This project was funded by the Australian Government through the then Department of Communications, Information Technologies and the Arts (DCITA).

#### **14:30 The Intelligent Watchdog: Sensors, Air and Land Vehicles Working Together As A Team**

##### **Andrew Lucas (Agent Oriented Software)**

Andrew Lucas is the founder and Managing Director of AOS Pty Ltd and of its subsidiaries in Cambridge, UK and Dallas. AOS specialises in the development of reasoning software for the rapidly developing field of intelligent robotics and autonomous systems.

Andrew holds a Ph.D. in Aeronautical Engineering from Cambridge University, United Kingdom and a Bachelor of Engineering (1st Hons) from the University of Melbourne, Australia. He has over 40 years of experience in various engineering roles in aerospace and defence, management consulting, robotic systems, artificial intelligence software, and telecommunications.

Andrew started in the aerospace industry in the design team of the Nomad light turboprop, and then for Rolls-Royce, Derby. He later founded The Preston Group (now Preston Aviation Solutions, a division of Boeing). He has nearly 20 years experience in the technology of Artificial Intelligence and Software Agents and their applications in simulation and robotics.

AOS is applying Artificial Intelligence technology to unmanned vehicles, and has recently trialled its “Intelligent Watch Dog”, and autonomous surveillance system, in conjunction with Insitu Pacific Limited and RMIT University. AOS is a founding partner in the UK national ASTRAEA Unmanned Air Systems program, together with BAE Systems, Airbus, Cobham, QinetiQ, Rolls-Royce and Thales.

AOS has financially supported 11 PhDs in artificial intelligence, robotics, autonomous and safety critical systems with RMIT, Melbourne, Cambridge, York and Sydney universities.

Andrew is a board member of the Australian Association of Unmanned Systems and is a member of the Royal Aeronautical Society’s Unmanned Air Systems Specialist Group.

#### **14:50 Acceptance, Expectation, and Trust in Human-Automation Interaction**

##### **Prof Liz Sonenberg (University of Melbourne)**

Liz Sonenberg’s research interests are in the design of software systems that exhibit complex behaviours, with particular emphasis on collaboration and teamwork. To date she has over 130 refereed publications, 19 PhD graduates, and attracted over \$2 million in national competitive grants from the Australian Research Council. Liz Sonenberg also holds the half-time role of Pro Vice-Chancellor (Research Collaboration and Infrastructure) at the University of Melbourne – with responsibility for ensuring the effective operation of a portfolio of interdisciplinary research clusters across the University, with oversight of University-wide policy regarding shared and collaboratively operated research infrastructure, and with a role in ensuring efficient operation of the University’s research information and business systems.

Much of her research focuses on agent technology, which views a distributed system in terms of interacting autonomous software entities. An important aspect is the requirement of the human-machine interface and consequent implications for the development of computational mechanisms to support human decision-making in complex settings.

As automated systems become more sophisticated in their capabilities, the design of effective interaction with human operators becomes more demanding. The goal of Liz Sonenberg’s major current collaborative project is to develop new formal techniques for representing and reasoning about joint task achievement in dynamic and somewhat unpredictable settings such as remote management of air or ground vehicles, or robot-assisted search and rescue operations. The focus of this project is informed by over a decade of collaborative engagement with DSTO and the work of several research students on software agent architectures. The medium term objective is to support the development of human-automation teams that can coordinate and collaborate in fast changing task environments.



**15:40 Autonomous Learning Systems: Design, Development and Deployment**  
**A/Prof Chee Peng (Centre For Intelligent Systems Research, Deakin University)**

Chee-Peng Lim received his PhD degree from University of Sheffield, UK in 1997. His research interests include design and development of computational intelligence-based systems for data mining, optimisation, and decision support. He collaborates closely with researchers in the international arena, whereby he received the Australia-India Senior Visiting Fellowship , 2013 (by Australian Academy of Science), Australia-Japan Emerging Research Leaders Exchange Program, 2013 (by Australian Academy of Technological Sciences and Engineering), Australia Endeavour Executive Award, 2009, Commonwealth Fellowship, 2003 (University of Cambridge, UK); Fulbright Scholarship, 2002 (University of California, Berkeley, USA). To date, he has published more than 270 technical papers in journals, conference proceedings, and books, received 7 best paper awards, edited 3 books and 12 special issues in journals, and served in the editorial board of 5 international journals. He is currently Associate Professor in Complex Systems, Centre for Intelligent Systems Research, Deakin University.

**16:00 Assessment of Autonomy - Handling Uncertainty about Behaviours and Decisions**  
**Prof Tristan Perez (Queensland University of Technology)**

Tristan Perez completed his Electronic Engineering degree in 1999 at The National University of Rosario in Argentina, and his doctorate in 2003 at The University of Newcastle in Australia in the area of constrained control of stochastic systems with application to ship dynamics. He is currently a Professor of Robotics and Autonomous Systems at the Queensland University of Technology (QUT), Brisbane, Australia. His areas of research include trusted autonomy, decision making under uncertainty, bio-inspired guidance and control of unmanned aircraft, Agricultural robotics, and energy-based modelling and control of cyberphysical systems.

In 2004, he was a research fellow at the University of Wales in the UK, where he worked on fault diagnosis of underwater vehicle propulsion systems. He then moved to Norway, where he worked on analytical and experimental modelling of ship dynamics and ship motion stabilisation at the Norwegian University of Science and Technology (NTNU)'s Centre of Excellence for Ships and Ocean Structures. He moved back to Australia in 2007 to the Australian Research Council for Centre for Complex Dynamic Systems and Control, where he worked in areas of modelling and control with applications in mining, econometrics, marine vehicles, aerospace manufacturing, and robust autonomy. From 2009 to 2012, Tristan was an Adjoint Associate Professor of Ship Dynamics at NTNU in Norway. In 2010, he was appointed Associate Professor and leader of the Mechatronics Programme at the University of Newcastle, Australia, where he developed the undergraduate programme on mechatronics engineering and the laboratory for robotics and autonomous system. In 2014, Tristan moved to QUT. He is currently the leader of IntelliSensing Enabling Platform at the Institute for Future Environments, an Associate investigator at Australian Centre for Robotic Vision, and an Honorary Professor of dynamics and control at the Queensland Brain Institute of the University of Queensland, Australia.



**20:00 Prof R.E. Burnett (National Defense University, USA)****A Survey of Humans and Autonomy**

Professor R. E. Burnett is a distinguished academic with the College of International Security Studies at the National Defense University.

His career began in 1986 with a BA in Political Science from the University of Missouri-Columbia followed in 1986 with a MA in International Affairs and International Science & Technology Policy from George Washington University.

Professor R.E. Burnett received his PhD in political science and Philosophy of Science in 1993. Since that time he has had a distinguished career in the field of National Defense, Science & Technology, Biodefense, and Diplomacy and International Commerce.

He is an analyst and theoretician in the field of emerging technologies who has recently been a featured speaker and researcher to the National Intelligence Council's science and technology committee.

Professor R.E. Burnett's research interests are Emerging and Disruptive Technologies, National Security, International Security, Science and Technology Policy, and National Security and Ethics.

He is a widely sought-after and engaging international speaker and will be addressing the Emerging Disruptive Technologies Assessment Symposium guests tonight on *A Survey of Humans and Autonomy*.