

## Workshop/Tutorial T3 (Half Day)

### UAV INTEGRATION INTO THE NAS: CHALLENGES, OPPORTUNITIES AND “*SOME OTHER COOL STUFF*”

#### Organiser:

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**Presenters:** *Dr. Terrence Martin, Dr. Aaron McFadyen, Mr David Guerin, Squadron Leader Adam Clarke*

#### Workshop Summary

The promise of UAV applications and technologies will not be realized until Beyond Visual Line of Sight (BVLOS) operations and operation over populated areas is permitted. However, a number of outstanding issues need to be resolved before that happens in more than one of instances. These include determinations around the level of technical integrity UAS need to demonstrate for particular operations, what the crew expectations will be, appropriate risk methodologies and training expectations for UAS pilots, and performance expectations for critical items like Detect and Avoid and Control links.

Delivering this intent requires targeted, collaborative effort from a range of stakeholders (academic, ATC, regulators, innovators) to target these critical technical and regulatory bottlenecks. This workshop provides each of these stakeholders with a better appreciation of the role they might play, and how their expertise will interact with other areas.

Over the course of the workshop, participants will be briefed on an array of contemporary issues affecting the speed of integration for RPAS into the NAS, and structured within 4 key areas:

- An Introduction to the NAS, ATM and UAS regulatory environment
- An overview of the emerging regulatory expectations for DAA/CNPC and assessment of current technology
- Data Driven Air Traffic Modelling: as it pertains to UAVs
- The Application space
  - UTM Trials in Australia
  - Overview of the challenges to integrating the RAAF MQ Triton into service

Further details on each section is provided below

Currently in its 4<sup>th</sup> year at ICUAS, the workshop has been iteratively improved by a team of academics, an experienced ATC and 2 military aerospace engineering officers. Further details on their credentials are provided at the end of this document.

#### Introductory Section

The workshop kicks off with an overview of automation and disruption and the impact it is having on economies around the world, drawing on the lesson espoused in Martin Ford’s bestseller “*Rise of the Robot*”, before expanding on the types of UAV related technologies that are most likely to have a profound effect on society.

With the aspirational scene setting complete, attendee will be introduced to the challenges that need to be overcome for full UAS integration into the NAS. This will include a working overview of the UAV regulatory environment, the extant Air Traffic Management System and the principles of airworthiness before detail of emerging risk based approaches to UAV regulation is provided.

This will include an overview of the recently developed JARUS Specific Operations Risk Assessment process, developed to support expanded UAS operations including BVLOS.

### **Detect and Avoid (DAA) and Command and Non Payload Communication (CNPC)**

Critical to expanded UAV operations are the Detect and Avoid (DAA) systems alongside Command and Payload Communication (CNPC). An overview of the recently released RTCA MOPS for DAA and CNPC will be provided, before a pragmatic market analysis of low SWAP Lidar, Radar, infrared and Laser Range finders for the purpose of DAA is worked through

### **Data Driven Air Traffic Modelling**

Critical to UAV integration into the NAS will be understanding, and representing the airside risk. To this end, attendees will be brief on recent effort in data-driven air traffic modelling. This presentation will include:

- A motivation for data-driven air traffic modelling for manned & unmanned aviation, how it's been conducted historically before reposing the problem for the UAS integration problem
- Outlining a new approach that has utility for:
  - UTM design, operational risk assessment (e.g., JARUS SORA) and insurance
  - Dynamic airspace allocation, short term traffic configuration prediction and deconfliction, etc
- Future Efforts

### **The Application Space**

- **BVLOS UTM Trials in Australia:** This section will outline recent UTM trials in Australia, examining the utility of 4 separate UTM providers and outlining the challenges in Test Case design, safety case development and trial planning and management
- **The ADF MQ-4C Triton:** Australia's maritime zones is one of the largest in the world (approx. 10 million km<sup>2</sup>), with the Search and Rescue (SAR) area comprising the Indian, Pacific and Southern Oceans also one of the largest in the world (also one of the largest in the world (53 million km<sup>2</sup>). The Australian Government intends to acquire 7 MQ-4C Triton UAVs, to support the RAAF in conducting Intelligence, Surveillance and Reconnaissance over Australia's maritime approaches. The aircraft will be the RAAF's first long range UAS and comes with some significant challenges in its implementation. This talk will include:
  - An introductory overview of the MQ-4C Triton capabilities
  - Insight into the Airworthiness challenges associated with the ADF risk based classification system and the implications for basing, flight over people and air traffic management implications including implementation of military 'Due Regard' procedures.
  - Importance of robust mission planning:

### **Target audience:**

- Entrepreneurs
- UAS practitioners, program managers, researchers and developers;
- Graduate students in electrical, mechanical, mechatronics, software and aerospace engineering.
- UAS technicians and system engineers
- UAS regulators;
- Air Navigation Service Providers
- Managers and technical professionals looking to extend UAS technology into agriculture, emergency services, utilities (rail, electricity, gas) and urban environments

### **Presenter Details**

#### **Associate Professor Martin**

Associate Professor Martin is an Adjunct at Queensland University of Technology, in the Image & Video Technologies laboratory. He is also the Applied Research Lead at Nova Systems. He holds a PhD in Machine Learning and his research interests include UAV Integration in the NAS, Detect and Avoid algorithm development and UAV Traffic Management (UTM). Professor Martin is the current Industry Chair of the CASA Australian UAS Standards Sub-Committee (UASSC), in addition to being a member of the international RTCA Steering Committee 228, which oversees standards for UAV

Detect and Avoid (DAA) and UAV Command links. Professor Martin is a former military engineering officer, having served in both the Australian RAAF, Army and Defence Science and Technology Group (DSTG) where he acquired significant skills as an engineer and project manager across a variety of manned and unmanned platforms. This experience includes maintaining aircraft in operational squadrons, training military aviators, intimacy with the principles of airworthiness and the systems engineering lifecycle alongside the vagaries of type accepting aircraft. The aircraft he has worked on include Conventionally Piloted Aircraft (F111-C, FA-18 Classic, CH47, ARH, Blackhawk, MRTT and AEW&C) and RPAS (Shadow and Heron). In 2015, he was seconded from ARCAA to support the Australian Navy in assessing the requirements for UAVs integrated onto Offshore Patrol Boats and Major Surface Combatants. He currently provides professional engineering consultancy advice to the Australian Army, Navy and Air Force on UAV related content.

### **Dr Aaron McFadyen**

Dr McFadyen is a post-doctoral research fellow at the Australian Research Centre for Aerospace Automation (ARCAA). He has a PhD in Robotics and Autonomous Systems, where he explored advanced vision-based decision and control strategies for UAV collision avoidance systems.

His current research is focused on development of innovative tools and techniques to accelerate integration of UAS/RPAS platforms into Australian Airspace and unleash their potential. His efforts include:

- Airspace Modelling (visualisation and analysis)
- UAV Flight Planning design, ATM route and sector re-partitioning to support increased UAV operations
- Big data, machine learning and pattern classification

This includes working closely with the Australian Air Navigation Service Provider (Airservices) and regulator, the Civil Aviation Safety Authority.

### **Mr David Guerin**

David is an experienced air traffic controller with more than 35 years of experience in diverse airspace across Australia and Europe. David has significant research experience on international aviation bodies while he was the Technical and Professional Secretary of the International Federation of Air Traffic Controllers' Associations and an independent observer on projects in the Single European Sky Joint Undertaking. His project focus areas include safety management and ATC standards for the integration of UAVs into controlled airspace. David has extended this experience into the emerging field of UAVs and is currently a technical team member of the NATO Science and Technology Organization (STO) Research task group looking at 'Risk-Based Safety Assessment of Operational Airworthiness and Certification Requirements for RPAS'

### **Squadron Leader Adam Clarke**

Squadron Leader Adam Clarke is serving as the Air Force Headquarters AIR7000 Liaison Officer at Patuxent River Naval Air Station, Maryland, where he has been stationed since 2016. He graduated from the Australian Defence Force Academy in 2002 with a Bachelor of Science, then subsequently completed his Navigator training at Canadian Forces Air Navigator School (CFANS) in Winnipeg in 2003. Upon return to Australia in 2004, he underwent Navigator/Communicator (NAVCOM) conversion on the AP-3C Orion before posting to 10SQN for his first operation tour. He completed his Tactical Co-ordinator (TACCO) conversion in 2006. Squadron Leader Adam Clarke has deployed to the middle east 2005, 2007 and 2009 with 10 Squadron, flying missions over Iraq and Afghanistan. He served as the Squadron TACCO Standards Officer from 2008. In 2010 Squadron Leader Clarke returned to 292 SQN as a TACCO/NAV Instructor. In 2013, he was posted to RAAF Darwin as the Deputy Commander of Joint Task Force 639 Air Component Co-ordination Element (JTF639 ACCE) in support of Operation Resolute.