

25th ICCRTS

International Command and Control
Research and Technology Symposium

Program

November 2-6 and 9-13, 2020

Symposium Chairs

David S. Alberts
Peter D. Houghton
Ken D. Teske



International Command and Control Institute

25th ICCRTS Tracks

C2 in the Information Age

Anthony Alston
Paul Gaertner
Bruce Forrester

Multi-Domain and Coalition C2

Mark Miller
Anthony Isenor
Richard Metzger

Understanding and Coping with Complexity

Russell Bryant
Emmeline Elliott
Alex Kalloniatis
Marielle Moktari

Managing and Governing C2 as a Holistic Capability

Paddy Turner
Magdalena Granasen
David Bryant

C2 and Human AI/Autonomy Teaming

Steven Mullins
Aletta Eikelboom
Glenn Moy
Hengameh Irandoust

Experimentation, Analysis, Assessment and Metrics

Adrienne Raglin
Jade Freeman
Jim Hill
David Connell
Keely McKinlay

Other C2 Related Research and Analysis

Patrick Guerin
Alexandre Bergeron-Guyard
Dave Shirley

Day 1 - Monday - November 2, 2020

**800EST
1300GMT**

25th ICCRTS Welcome and Orientation
David S. Alberts, Ken Teske, and Peter Houghton

900

The Science of Command and Control: First 25 Years
David S. Alberts

1000

Track Chair Overview
Experimentation, Analysis, Assessment and Metrics

1030

**(11) Asset Tracking Using LoRaWAN:
Experiments Concerning Effective Range and Signal Interception**
Frank Johnsen and Torkjel Søndrol

1100

**(19) Building the Command and Control Range:
Measuring C2 Approach in the C2 Range**
Robert Cameron and Ahmed Ghanmi

1130

**(34) Tactical Interoperability with JC3IEDM:
Performance Measurements**
Anderson Ferreira De Oliveira, Tomas Aquino Botelho, Edmundo Cecilio

1200

**(38) Command and Control Agility Performance Metrics:
A Practical Approach**
Manuel Arriagada

1230

**(55) C2 Sketch:
Rapid Definition and Testing of Task-Oriented C2 Systems**
Bas Lijnse, Jan Martin Jansen, Fok Bolderheij and Ben van Asten

Day 2 - Tuesday - November 3, 2020

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| 800EST | Discussion |
| 1300GMT | Experimentation, Analysis, Assessment and Metrics |
| 830 | Challenges for the C2 Research Community John J Garstka <i>US Department of Defense</i> |
| 930 | (59) Evaluation of Message Broker approaches for Information Exchange In Disadvantaged Tactical Networks in a Federated Environment <i>Frank Johnsen, Marco Manso and Norman Jansen</i> |
| 1000 | (66) Emerging needs for C2 research capability –a literature review <i>Peter Svenmarck, Charlotte Stenius, Björn J.E. Johansson, Ove Jansson and Kristofer Bengtsson</i> |
| 1030 | (71) In the face of uncertainty: The effects of presenting increased degrees of imprecise probabilities in risk descriptions in time critical decision-making situations <i>Joacim Rydmark</i> |
| 1100 | (97) Experimental Evaluation of the Mockets Communications Protocol at the Tactical Edge <i>Jade Freeman, Tim Gregory, Mike Lee, James Michaelis and Theron</i> |
| 1130 | (105) Image-Audio Encoding to Improve C2 Decision-Making in Multi-Domain Environments <i>Piyush Sharma and Adrienne Raglin</i> |
| 1200 | (108) Command and Control States as a means of enabling C2 Resilience <i>Alexander Bain</i> |
| 1230 | (76) C2 support in complex and dynamic situations <i>Judith van de Kuijt and Deborah Lassche</i> |

Day 3 - Wednesday - November 4, 2020

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| 800EST 1300GMT | Reflections |
| 830 | Transformation and Institutional Change <i>Benjamin Talyor</i> <i>Chief Executive of the Public Service Transformation Academy</i> |
| 930 | Track Chair Overview Managing and Governing C2 as a Holistic Capability |
| 1000 | (18) Operationalizing Multi-Domain C2 in the US Military <i>Mark Tillman and Kathleen Conley</i> |
| 1030 | (92) C2 as a Capability in the Land Environment: principles of road map design <i>Patrick Turner</i> |
| 1100 | (116) Exploratory study to identify and model barriers to organisational learning in a command and control context <i>Matthew Fewtrell</i> |
| 1130 | (117) C2 Capability—Why do we fail to improve it? Exploring Barriers to the Development of C2 Capability <i>Per Wikberg, David Bryant, Peter Houghton, Magdalena Granåsen</i> |
| 1200 | (118) Multilevel Model for Command and Control <i>Eldad M. Shamash</i> |
| 1230 | Discussion Managing and Governing C2 as a Holistic Capability |

Day 4- Thursday - November 5, 2020

800EST
1300GMT

Reflections

830

**Track Chair Overview
Other C2 Research and
Analysis**

900

**(1) Improving Naval Aviation Readiness Using
Explainable Predictive Analytics
*Benjamin Michlin, Josh Duclos and Gary Williams***

930

**(12) A Novel IoT Security Assessment Framework:
LoRaWAN Case Study
*Federico Mancini and Frank Johnsen***

1000

**(20) Parakeet: a C2 Framework for
Efficient AI Capability Development
*Valerie Lavigne and Mélanie Breton***

1030

**(24) Enabling data driven multi-int analysis:
implications and exploitation framework
*Alexandre Bergeron Guyard***

1100

**(37) How C2 Can Benefit from 3D Modeling of
Urban Environments for Military Operations
*Marielle Mokhtari***

1130

**(41) Constructing C2 systems with Agility
*Zhuyun Duanmu, Haoyu Li and Xiaobin Mao***

1200

**(74) Time aspects of command and control
*Ulrik Spak***

1230

**(82) Problems and considerations of sensor C2
in a future operational environment
*Mats Carlerby***

Day 5- Friday - November 6,
2020

800EST
1300GMT

Track Chair Overview
C2 in the Information Age

830

(27) Coronavirus: Gray Zone Tactics in Cyberspace
Ritu Gill, Meghan Fitzpatrick, Anthony Seaboyer, Matthew Duncan

900

(36) Quantum Communication for Military Applications
Niels Neumann, Maran van Heesch, Patrick de Graaf

930

(39) Understanding Urban Operational Environments
By Integrating Human and Physical Domains
Marie-Eve Jobidon and Marielle Mokhtari

1000

(60) Mathematical Modelling of Headquarters C2 Battle
Rhythm for Multi-Domain Operations
Alexander Kalloniatis

1030

(65) BPMN-Driven Real-Time Mission Awareness.
Brian Krisler, David Diller, Jeff Miller, Tyler Marshall and John Myers

1100

(91) Towards a Deception Framework for Social Media
Bruce Forrester and Frederike Von Franqué

1130

(111) Modeling Value of Information in Command and Control Domain
Jade Freeman

1200

(120) Enabling and Managing Data Provenance in a
Command and Control Environment
Jeff Waters, Cheryl Putnam, James Chao and Barbara Rasmussen

1230

(122) Agile Control: Distributed Collaborating Deciders
John O'Neill, Ricky Ballard, Dave Turner, Milan Koprek, Roger Symons, Peter Davies and Gina Kingston

Day 6 - Monday - November 9, 2020

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| 800EST 1300GMT | Discussion C2 in the Information Age |
| 830 | Topic: C2 in the Information Age Professor Helen Margetts University of Oxford and Turing Institute |
| 930 | (88) <i>A Proposed Hardware-Software Architecture for C5ISR System in the Amazon Operations</i> <i>Abel Oliveira and Nina Figueira</i> |
| 1000 | (100) Potential Impacts of Quantum Technologies on Future Command and Control (C2) <i>Ken Teske and Patrick Guerin</i> |
| 1030 | (113) A campaign-based approach for C2 capability development <i>Jim Hill, Gary Smith, Patrick Turner and Chris Groves</i> |
| 1100 | (114) Identifying challenges in military HQs to guide C2 research and development <i>Richard Ellis and Jim Hill</i> |
| 1130 | (115) A generalized two side analysis of multi-faction conflicts <i>Bao Nguyen</i> |
| 1200 | (123) The RISEN Project A Novel Concept for Real-time on-site Forensic Trace Qualification <i>Marco Manso, Roberto Chirico, Johannes Peltola, Philip Engstrom, Håkan Larsson and Jimmy Berggren</i> |
| 1230 | Discussion Other C2 Related Research and Analysis |

Day 7 - Tuesday - November 10, 2020

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| 800EST 1300GMT | Track Chair Overview C2 and Human AI/Autonomy Teaming |
| 830 | Topic: C2 and Emerging Technologies <i>Professor Nick Holliman</i> <i>University of Newcastle and Turing Institute</i> |
| 930 | (51) Human-AI Teaming with the Digital Battlespace Framework <i>Payam Mousavi, Emilena Specht, Gary Reedel, Jerry Lim, Jennifer Busler</i> |
| 1000 | (14) Multi-Agent Systems Collaborative Teaming (MASCOT) Definition Process to Create Specifications for Multi-Agent System (MAS) Development <i>Curtis Heisey, Marc Brittain, Donald Evan Maki and Kevin Bush</i> |
| 1030 | (40) Police-AI Teaming: Development of User-Centric Incident Profile Platform for the Dutch Police <i>Tamar Schaap, Shanna Wemmers, Roos Bakker, Ward Venrooij,</i> <i>Michael Kooning, Mirjam Huis In 't Veld and Reinout Pieneman</i> |
| 1100 | (106) Future hybrid human-robot teams: Functional requirements for Non-human Intelligent Collaborators (NICs) in an operational context <i>Willeke van Vught, Aletta Eikelboom, Tom Hueting, Jef</i> <i>van Schendel and Nanja Smets</i> |
| 1130 | (61) One Ring to Rule them All ... and through the Headquarters Bind them: AI, emergence, and the Planning- Execution-Evaluation Continuum in a Fifth Generation Headquarters <i>Alexander Kalloniatis, Martin Oxenham, Hing-Wah Kwok, Mark Unewisse</i> |
| 1200 | (63) An initial study of applying a semi-autonomous UCGV in land warfare <i>Björn Johansson, Kristofer Bengtsson, Per-Anders Oskarsson,</i> <i>Peter Svenmarck and Jesper Pettersson</i> |
| 1230 | Discussion C2 and Human AI/Autonomy Teaming |

Day 8 - Wednesday - November 11, 2020

800EST
1300GMT

Track Chair Overview
Understanding and Coping with Complexity

830

What is the sense of sense-making?
Professor Chris Baber
University of Birmingham

930

(89) Assessing the Endeavor Space using the C3Fire Microworld
Oscur Bjurling, Rego Granlund, and Bjorn Johansson

1000

(9) Sowing Discord, Countering Fear:
Force Protection and Resilience to Disinformation
Meghan Fitzpatrick

1030

(21) Convergence in Understanding
Complex Information Environments Through Error Reduction
Matthew Duncan and Ritu Gill

1100

(28) Avoid Predictability in COA Development for
Missions Coping with Complexity
Isabell Andersson, Anders Josefsson and Christer Svanborg

1130

43) Organizational Agility and Resilience:
Lessons from Distributed Operations
*Jose Carreno, Scott Crellin, Patricia-Ann Paule, Shane Riley,
Glenn Tolentino and John Wood*

1200

(53) Unsupervised creation of profiles for information filtering
Ahmed Owais, Gökgöz Fahrettin and Hans-Christian Schmitz

1230

(3) The Impacts of Utilizing Non-human Intelligent Collaboration
the Appropriateness of C2-Harmonization Arrangements
David Alberts and Marvin L. Simpson Jr

Day 9- Thursday - November 12, 2020

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| 800EST 1300GMT | Reflections |
| 830 | (107) Assessing Information Effects within a Complex Multi-Domain Operation <i>Gavin Pearson, Chris Parry, Paul Stanley and Brian Stewart</i> |
| 900 | (85) Is the Future of C2 Doctrine Anti-Positivism? <i>Tim Grant</i> |
| 930 | (110) Enhancing Sensemaking: Supporting Distributed Groups in the Future Operating Environment <i>Elliott, E., Attfield, S., Minocha, S., Fields, B., Hutton, R., Baber, C.</i> |
| 1000 | Discussion Understanding and Coping with Complexity |
| 1030 | Critical Decision-Making in a Multi-Dimensional Environment <i>Professor Anthony King</i> <i>University of Warwick</i> |
| 1130 | Track Chair Overview Multi-Domain and Coalition Command and Control |
| 1200 | (5) Mobility Nodes Beyond the Tactical Edge for Close Air Support Situational Awareness and Survivability <i>Kevin Diaz</i> |
| 1230 | (16) The influence of harmonization levels on multi-domain operations effectiveness: The moderating roles of organizational environment and command and control variety <i>Sigmund Valaker, Rune Stensrud, Torgar Haugen, Ingrid van Bommel and Aletta Eikelboom</i> |

Day 10- Friday - November 13, 2020

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| 800EST 1300GMT | (17) 5th generation fighter aircraft and future command and control: A note on some possible change <i>Rune Stensrud, Bjørn Mikkelsen and Sigmund Valaker</i> |
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| 830 | (25) Data-driven, Service-oriented, Knowledge-based Command and Control <i>Jack Verhoosel, Barry Nouwt and Jeroen Voogd</i> |
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| 900 | (26) Aligning Multi-Domain Command and Control (C2) and Cybersecurity <i>Ken Teske, Mark Miller and Patrick Guerin</i> |
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| 930 | (42) When Things Go Amiss: Lessons For Successful International Partnerships In the Defense Research and Development Community <i>Jose Carreno, Paul Shigley, Clare Morton and George Galdorisi</i> |
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| 1000 | (45) Simulation in NATO Federated Mission Networking. <i>J. Mark Pullen, Kevin Galvin and R. Adam Brook</i> |
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| 1030 | (58) Data centric C2-services deployment: an experiment on fleets of military vehicles <i>Geert Pingen, Johan van der Geest, Merle Beaujon, Jeroen Voogd and Reinout Pieneman</i> |
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| 1100 | (62) The Exploitation of C2SIM Standards in Support of Evolving Command and Control Capabilities <i>Adam Brook, Brian Wardman and Bharat Patel</i> |
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| 1130 | (109) A Perspective of Multi-domain Battlespace Management <i>Andrew Williamson</i> |
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| 1200 | (112) Defence Support to Multi-Domain Operations: Fusion in Practice <i>Graham Davies</i> |
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| 1230 | Discussion Multi-Domain and Coalition Command and Control |
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