

24th INTERNATIONAL
COMMAND AND CONTROL
RESEARCH & TECHNOLOGY SYMPOSIUM
29-31 OCTOBER - LAUREL, MARYLAND, USA

2019

Symposium Program

Theme:

Cyber Risk to Mission

hosted by



Symposium Chairs

David Alberts

Program Chairs

Ken Teske

Arrangements Chair

Jimmie McEver



International Command and Control Institute

Tracks and Track Chairs

Topic 1: Cyber Risk to Mission - Patrick Guerin

Topic 2: C2 Concepts, Theory, Policy, Methodology and Approaches – Russell Bryant

Topic 3: Battlefields of the Future and the Internet of Intelligent Things – Justin Schmidt / Patrick Guerin

Topic 4: Cognitive and Socio-technical Challenges – Aletta Eikelboom

Topic 5: Highly Connected, Automated, and Autonomous Forces - Frank Trethan Johnsen / Marco Manso

Topic 6: Interoperability, Integration and Security – Kevin Galvin

Topic 7: Operational Issues: Multi-domain and Coalition Command and Control – Robert Rosas / Mark Miller

Topic 8: Information and Knowledge Systems – Greg Robinson and Mark Miller

Topic 9: Experimentation, Analysis, Assessment and Metrics – Jade Freeman / Adrienne Raglin

Topic 10: Other C2 / Cyber Related Research and Analysis – Ken Teske

Tuesday, October 29

	Room A	Room B	Room C
Session 4	51	73	11
	58	68	14
	15	47	45

Wednesday, October 30

	Room A	Room B	Room C
Session 8	19	12	22
	21	16	4
	75	74	76

lunch

Session 9	9	55	46
	62	65	72
	54	67	36

Thursday, October 31

	Room A	Room B	Room C
Session 13	38	61	42
	49	1	52
	56	69	35
Session 14	70	3	40
	2	5	17
	31	10	23

lunch

Session 15	33	39	8
	48	29	71
	27	18	53

Track 1
Track 2
Track 3
Track 4
Track 5
Track 6
Track 7
Track 8
Track 9
Track 10

Symposium Overview

Tuesday, October 29

- 08:00-09:00 Check-In - Continental Breakfast
- 09:00-09:30 Welcome
- 09:30-10:30 **Keynote Presentation: Cyber Security and Risk to Mission**
- 10:30-11:00 Break
- 11:00-12:00 **Track Chair Previews**
- 12:00-13:00 Lunch
- 13:00-14:30 **Track Sessions (4A, 4B, 4B)**
- 14:30-15:00 Break
- 15:00-16:30 **Panel: Joint and Coalition Command and Control**
- 16:30-17:30 **Presentation: The Dragonfly Mission to Titan: C2 Challenges of Space Exploration**
- 17:30-19:00 Reception

Wednesday, October 30

- 08:00-08:30 Check-In - Continental Breakfast
- 08:30-09:00 Reflections
- 09:00-10:00 **Presentation: Introduction to ELICIT Ecosystem**
- 10:00-10:30 Break
- 10:30-12:00 **Track Sessions (8A, 8B, 8 C)**
- 12:00-13:00 Lunch
- 13:00-14:30 **Track Sessions (9A, 9B, 9B)**
- 14:30-15:00 Break
- 15:00-16:00 **Presentation: Command and Control Research Challenges**
- 16:00-17:00 **Panel: Managing Cyber Risk to Mission in the National Security Enterprise**

Thursday, October 31

- 08:00-08:30 Check-In - Continental Breakfast
- 08:30-09:00 Reflections
- 09:00-10:30 **Track Sessions (13A, 13B, 13C)**
- 10:30-11:00 Break
- 11:00-12:30 **Track Sessions (14A, 14B, 14C)**
- 12:30-13:30 Lunch
- 13:30-15:00 **Track Sessions (15A, 15B, 15B)**
- 15:00-15:30 Break
- 15:30-16:30 **Keynote Presentation: Cyber Risk to Mission**
- 16:30-17:00 **Best Paper Award Presentation**

Tuesday October 29

08:00-09:00 Check-In - Continental Breakfast

09:00-09:30 Welcome

9:30-10:30 Keynote Presentation

Agility in Digital modernization

Don Heckman

Principal Deputy Chief Information Officer for Cybersecurity, US DoD

10:30-11:00 Break

11:00-12:00 Plenary Presentation

Track Chair Previews

12:00-13:00 Lunch

13:00-14:30 Session 4A: Track 9

(51) Darius Jefferson, Andre Harrison and Mark Dennison
MEAP 2: An Update to MEAP for Streaming Data

Andre Harrison, Michael Green, Chou Hung and Adrienne Raglin.
(58) **The Consistency of Visual Search Models on High Dynamic Range and Tone Mapped Images**

Frank Johnsen, Trude Bloebaum, Norman Jansen, Gerome Bovet, Marco Manso, Andrew Toth and Kevin Chan.
(15) **Evaluating Publish/Subscribe Standards for Situational Awareness using Realistic Radio Models and Emulated Testbed**

Tuesday October 29

13:00-14:30 Session 4B: Track 4

- Irena Ali and Keely McKinlay
(73) **The Dungeon Effect: The importance of biophilic design to C2 effectiveness in military environments**
- Carien Van T Wout, Shaun Ball and Heloise Pieterse.
(68) **Management of Deployment Stress in the Cyber Age**
- Arild Bergh
(47) **Massage the message: Modularising software for influence operation detection in social media**

13:00-14:30 Session 4C: Track 3

- Shaun Ball, Carien Van'T Wout and Rudolph Oosthuizen.
(11) **A Framework for Implementing a Data Science Capability in a Military Intelligence System**
- Frank Johnsen, Trude Bloebaum and Philip Puente
(14) **Towards friendly force tracking with MQTT over LoRa**
- Tim Grant
(45) **Tsunami of Smallsat Mega-Constellations: C2 implications**

14:30-15:00 Break

Tuesday October 29

15:00-16:30

Joint and Coalition Command and Control Panel Discussion

Panel Chair: Mark Unewisse, Defence Science and Technology Group Australia

Dr. Irena Ali, Senior Researcher, DST, Australia

Mr. Paul Garnham, Defence Technology Agency, New Zealand

Mr. David Connell, Canadian Forces, Canada

Ms. Carol Cooper-Chapman, Dstl, (tentative), United Kingdom

Ms. Olinda Rodas, Human Factors Scientist, NIWC Pacific, United States

16:30-17:30

The Dragonfly Mission to Titan: C2 Challenges of Space Exploration

Mike Ryschewitsch

Head, APL Space Exploration Sector

Ken Hibbard

Dragonfly Mission Systems Engineer

17:30-19:00

Reception

Wednesday October 30

08:00-08:30 Check-In - Continental Breakfast

08:30-09:00 Reflections

09:00-10:00 Presentation

Introduction to ELICIT: A Research, Training, and Educational Ecosystem

David S. Alberts

Senior Fellow, Institute for Defense Analyses

10:00-10:30 Break

10:30-12:00 Session 8A Track 9

David Connell and Ahmed Ghamni

(19) **Information Related Capabilities: Targeting Cycle Experimentation and Analysis**

Regina Joseph, Marieke Klaver, Judith van de Kuijt and Diederik van Luijk

(21) **Training and evaluating cyber analytical expertise**

Somiya Metu, Adrienne Raglin and Dawn Lott

(75) **Automation of IoT based Decision Making with Uncertainty**

10:30-12:00 Session 8B Track 4

Rudolph Oosthuizen and Carien Van'T Wout

(12) **A Sociotechnical System Perspective on Artificial Intelligence Implementation for Modern Intelligence Systems**

Celine Karud, Frank Johnsen and Trude Bloebaum

(16) **A socio-cognitive perspective on implementation and use of smart technology in the Norwegian home guard**

Esther Kox, José Kerstholt, Tom Hueting, Jonathan Barnhoorn and Aletta Eikelboom

(74) **Autonomous Systems as Intelligent Teammates: Social Psychological Implications**

Wednesday October 30

10:30-12:00 Session 8C Track 2

- James Gibson
- (22) **Applying first principles to reframe how we enable the 5th Generation Force**
- David Alberts
- (4) **Is a Bespoke Design for Multi-Domain C2 Necessary?**
- Gordon Niven and David Capewell
- (76) **The Variety Calculus - an alternative proposition for command & control in a complex world**

12:00-13:00 Lunch

13:00-14:30 Session 9A Track 9

- Timothy Darr, Daniel Houser, Jianxin Wang and Richard Mayer
- (9) **Time-pressure improves decisions in generalized Colonel Blotto games**
- Magdalena Granåsen, Gazmend Huskaj and Stefan Varga
- (62) **Data Collection and Research in CDXs - Command and Control, Cyber Situational Awareness and Intelligence Perspectives on Cyber Defense**
- Erin Zaroukian
- (54) **Automated information extraction to facilitate comprehension across text difficulty levels**

Wednesday October 30

13:00-14:30 Session 9B Track 7 and Track 1

Steven Mullins

(55) **Information-Sharing Patterns in Action Teams: Understanding Cognitive Interactions in Dynamic Environments**

(65) Ritu Gill, Judith van de Kuijt, Magnus Rossell and Ronnie Johansson
Disinformation in the Cyber Domain: Detection, Impact, and Counter-Strategies

(67) Rosalie Mcquaid and Thomas O'Neill
Countering Cyber Risk to Mission Through a Cyber Hardening Framework 13:00-14:30 Session 9C Track

Mats Carlerby and Björn Johansson
(46) **Sensor C2 in a future operational environment - A Suggestion for an experimental study**

Mark Nissen, Shelley Gallup, Paul Shigley and Robert Tanner
(72) **Power Implications within Command and Control Organizations: New Insights through Knowledge Measurement**

Anders Josefsson, Björn Marcusson, Joseph Anderson and Arne Norlander
(36) **Mission Command when waging cyber operations**

14:30-15:00 Break

15:00-16:00 Presentation

Command and Control Research Challenges

A Perspective from the Applied Research Laboratory for Intelligence and Security

Dr. Craig Lawrence

Director, Systems Research, ARLIS, University of Maryland at College Park

16:00-17:00 Panel Discussion

**Managing Cyber Risk to Mission
in the National Security Enterprise**

Thursday October 31

08:00-08:30 Check-In - Continental Breakfast

08:30-09:00 Reflections

9:00-10:30 Session 13A Track 9

(38) Gilles Desclaux
Reading the Mind of the Enemy through an Augmented Multi-Domain CCIR Process

(49) James Michaelis
Platforms for Assessment of Content Prioritization in C3I GIS Systems

(56) Björn Johansson, Oscar Bjurling, Jacob Weilandt, David Alberts and Mats Carlerby
An initial assessment of the Endeavour space dimensions

9:00-10:30 Session 13B Track 7 and Track 1

(61) Alexander Kalloniatis
Modelling Multi-Domain C2 with network synchronisation: a cyber based use-case

(1) Lenard Simpson
Multi Domain Command and Control (MDC2) an Execution Vision

(69) James Thaba
Developing Cyber capabilities as an integral part of Command and Control

Thursday October 31

9:00-10:30 Session 13C Track 2 and Track 5

- Ulrik Spak
- (42) **Effective and efficient command and control: A concept method for inquiring the impact of visual representation on order quality**

- Nina Figueira, Marlos Corrêa, Angelo Borzino, Pierre Mattei and Giancarlo Niedermeier Belmonte
- (52) **C4ISTAR Evolving C2 Brazilian Army Doctrine - A Tactical Study of an Amazonian Scenario**

- Marco Manso, Barbara Guerra, Norman Jansen, Kevin Chan, Frank Johnsen, Trude Bloebaum, Andrew Toth and Fernando Freire
- (35) **Mobile Tactical Forces: Experiments on Multi-broker Messaging Middleware in a Coalition Setting**

10:30-11:00 Break

11:00-12:30 Session 14A Track 9 and Track 6

- Craig Bleile
- (70) **A Method to Model a Digital Network Supporting Mission Type Orders for Command and Control in a Contested Environment**

- Russell Bryant Jr.
- (2) **Balancing Cyber Risk and Investment with Mission Execution and Success – Are Improvements Available? – Balance Factors' Discussion and Suggestions**

- George Galdorisi, Jose Carreno and Paul Shigley
- (31) **Ensuring Allies and Coalition Partners Can Leverage C4ISR Technologies to Manage Cyber Risk to Mission**

Thursday October 31

11:00-12:30 Session 14B Track 1

(3) Ken Teske, Patrick Guerin and Mark Miller
Aligning Command and Control (C2) and Cyber Risk to Mission

(5) Francois Rheaume
Risk-based cyber mission assurance model, process and metrics

(10) Maxwell Dondo
Determination of asset criticality for decision support in operational networks

11:00-12:30 Session 14C Track 5 and Track 8

(40) Kevin Chan, Gregory Judd, Claudia Szabo, Vanja Radenovic, Peter Boyd and Kelvin Marcus
Networked information transfer strategies for Multidomain Command and Control

(17) Frank Johnsen and Ida Frøseth
SMART II: Android apps, cloud computing and mobile device management as enablers for efficient operations

(23) Hans-Christian Schmitz, Alessia Cornaggia-Urrigshardt, Fahrettin Goekgoez, Samantha Kent and Kevin Wilkinghoff
Calm interfaces for integrated C2 systems

12:30-13:30 Lunch

Thursday October 31

13:30-15:00 Session 15A Track 6

- (33) J Mark Pullen, Brian Wardman and James Ruth **Experimental Evaluation of a Command and Control – Simulation Interoperation Standard in a Coalition Environment**
- (48) Anderson Ferreira De Oliveira, Tomas Aquino Botelho and Manoel Pedro Sá
Command and Control Interoperability Middleware Architecture (INTERC2)
- (27) Adam Brook, Brian Wardman, Kevin Galvin and Deryck Arnold
Implementing a Prototype Reach-back Capability for Decision Support in Multi-domain and Coalition Operations

13:30-15:00 Session 15B Track 1 and Track 10

- (39) Ken Teske, Patrick Guerin, Mark Miller, Justin Schmidt, Robert Rosas and Gregory Robinson
Data is the key to Cyber Risk to Mission
- (29) Marius Vassiliou
C2 in the Mafia
- (18) Duanmu Zhuyun, Feng Ding and Haoyu Li
Uncertainty-Oriented resource selecting method for Agile command and control system

Thursday October 31

13:30-15:00 Session 15C Track 8

- (8) Timothy Darr, Richard Mayer, R. David Jones, Timothy Ramey, Ryder Smith and Chris Zimmerman
Quantum Probability Models for Decision Making
- (71) Andrew Zschorn, Hing-Wah Kwok and Wolfgang Mayer
Microservice API design to support C2 semantic integration
- (53) Nina Machado Figueira, Angelo Marcio Cardoso Ribeiro Borzino and Marlos De Mendonca Correa
C4ISTAR in Brazilian border security – a proposal of a Mobile Surveillance Network to integrate Brazilian Army Defense System.

15:00-15:30 Break

15:30-16:30 Keynote Presentation

Cyber Risk to Mission

John J. Garstka

Director, Cyber (OUSD A-S)

16:30-17:00 Ceremony

Best Paper Award Presentation

Conclusion of Symposium

Best Paper Nominees

- (5) Francois Rheume
Risk-based cyber mission assurance model, process and metrics
- (36) Anders Josefsson, Björn Marcusson, Joseph Anderson and Arne Norlander
Mission Command when waging cyber operations
- (11) Shaun Ball, Carien Van'T Wout and Rudolph Oosthuizen.
A Framework for Implementing a Data Science Capability in a Military Intelligence System
- (12) Rudolph Oosthuizen and Carien Van'T Wout
A Sociotechnical System Perspective on Artificial Intelligence Implementation for Modern Intelligence Systems
- (40) Kevin Chan, Gregory Judd, Claudia Szabo, Vanja Radenovic, Peter Boyd and Kelvin Marcus
Networked information transfer strategies for Multidomain Command and Control
- (48) Anderson Ferreira De Oliveira, Tomas Aquino Botelho and Manoel Pedro Sá
Command and Control Interoperability Middleware Architecture (INTERC2)
- (65) Ritu Gill, Judith van de Kuijt, Magnus Rossell and Ronnie Johansson
Disinformation in the Cyber Domain: Detection, Impact, and Counter-Strategies
- (71) Andrew Zschorn, Hing-Wah Kwok and Wolfgang Mayer
Microservice API design to support C2 semantic integration
- (15) Frank Johnsen, Trude Bloebaum, Norman Jansen, Gerome Bovet, Marco Manso, Andrew Toth and Kevin Chan.
Evaluating Publish/Subscribe Standards for Situational Awareness using Realistic Radio Models and Emulated Testbed
- (29) Marius Vassiliou
C2 in the Mafia



International Command and Control Institute

www.internationalc2institute.org

What is IC2I?

The International Command and Control Institute (IC2I) is a nonprofit corporation under the US Internal Revenue Code Section 501 (c) (3) created exclusively for scientific and educational purposes. The focus of the Institute is on enhancing our understanding of emerging technologies, and their implications for command and control of complex enterprises and endeavors operating in highly dynamic and contested environments. These technologies are enabling the creation of socio-technical organizations that are learning to leverage networked human-machine collaborations that employ autonomous systems, real and virtual.

Why was IC2I created?

The Command and Control Research Community, composed of an international community of researchers (from industry, academia and government) and practitioners (e.g., military, emergency services), has, over the past 20 years, created an invaluable body of literature that was about to become inaccessible to researchers and practitioners due to uncertain Government funding. The annual gathering of this community, the International C2 Research and Technology Symposium (ICCRTS), was also in danger of being disrupted or discontinued. IC2I was created, in part, to ensure both the continued access to this important body of literature and the continuation of ICCRTS meetings so that researchers could continue to build upon previous work by interacting and collaborating with one another.

How is IC2I funded?

The Institute currently receives no direct Government support. Its creation was funded by private donations. The initial donors established a goal for IC2I to become funded by memberships and proceeds from events and publications. A portion of this year's ICCRTS registration fee will be used to cover the costs of maintaining on-line access to the body of literature and planning for future events. Participants in ICCRTS will receive a one-year membership in the Institute that will enable them to access the symposium proceedings and archives. They will also receive a membership discount to future events.