Symposium Program

Theme:
Collective C2: Working with Partners

hosted by

Symposium Chairs:

David S. Alberts
Micheline Belanger
Richard Giguere
Denis Laurendeau

International **Command and Control** Institute

Tracks and Track Chairs

Track 2: Operating in a Contested Cyberspace Environment - Natalie Nakhla – Maxwell Dondo

Track 3: Coping with Constraints, Complexity and Ambiguity - Valerie Lavigne

Track 5: Emerging concepts and Technologies - Bruce Forrester, Zachary Devereaux

Track 6: Connected Battlespaces and Forces - Phil Farrell

Track 7: Experimentation, Analysis, Assessment, and Metrics - Luc Pigeon, Paul Gaertner

Track 8: Military C2 Applications, Requirements, Concepts, and Solutions - Keith Stewart

Day 1 - October 25th		
10:30am	Track Session Overview	
11:00am	Session A1 T5-056	Session B1 T2-005
11:30am	Session A2 T5-008	Session B2 T2-007
1:00pm	Session A3 T5-028	Session B3 T2-012
1:30pm	Session A4 T5-035	Session B4 T8-063
2:00pm	Session A5 T5-037	Session B5 T3-006
3:00pm	Session A6 T5-061	Session B6 T3-065
3:30pm	Session A7 T5-015	Session B7 T3-013
4:00pm	Session A8 T5-023	Session B8. T3-054
4:30pm	Session A9 T5-034	Session B9. T3-048
5:00pm	*Session A10 Discussion*	*Session B10 Discussion*

Day 2 - October 26th		
10:30am	Session A11 T5-024	Session B11 T6-014
11:00am	Session A12 T5-011	Session B12 T6-038
11:30am	Session A13 T5-036	Session B13 T6-047
1:00pm	Session A14 T5-050	Session B14 T6-052
1:30pm	Session A15 T5-031	Session B15 Discussion
2:00pm	Session A16 T5-010	Session B16 T7-059
3:00pm	Session A17 T5-060	Session B17 T7-030
3:30pm	Session A18 Discussion	Session B18 T7-020

Day 3 - October 27th		
10:30am	Session A19 T8-017	Session A19 T7-055
11:00am	Session A20 T8-033	Session B20 T7-027
11:30am	Session A21 T8-026	Session B21 T7-039
1:00pm	Session A22 T8-025	Session B22 T7-004
1:30pm	Session A23 T8-009	Session B23 T7-053
2:00pm	Session A24 T8-042	Session B24 T7-019
3:00pm	Session A26 Discussion	Session B25 T7-022
3:30pm		Session B26 Discussion

Symposium Overview

Tuesday, October 25

07:30-08:30	Check-In – Coffee
08:30-09:30	Welcome
09:00-10:00	Keynote Presentation: Brigadier-général Stephane Boivin
	Commander, 2nd Canadian Division and Joint Task Force (East)
10:00-10:30.	Break
10:30-11:00	Track Chair Previews
11:00-12:00	Track Sessions (A & B 1,2)
12:00-13:00	Lunch
13:00-14:30	Track Sessions (A & B 3,4,5)
14:30-15:00	Break
15:00-17:30	Track Sessions (A & B 6,7,8,9,10)
17:30-19:00	Reception

Wednesday, October 26

08:00-08:30	Check-In - Coffee
08:30-09:00	Reflections
09:00-10:00	Keynote Presentation: Mr. John Garstka, Director, Cyber Warfare US OSD
10:00-10:30	Break
10:30-12:00	Track Sessions (A & B 11,12,13)
12:00-13:00	Lunch
13:00-14:30	Track Sessions (A & B 14,15,16)
14:30-15:00	Break
15:00-16:00	Track Sessions (A & B 17,18)
16:15	Bus Departs for Tour-Dinner (optional)
21:30	Bus Returns to ULaval (estimated)

Thursday, October 27

08:00-08:30	Check-In – Coffee
08:30-09:00	Reflections
09:00-10:00	Panel: C2 Resilience in sub-Threshold Warfare. Chair: Dr. Paul Gartner
10:00-10:30	Break
10:00-12:00	Track Sessions (A & B 19,20,21)
12:00-13:00	Lunch
13:00-14:30	Track Sessions (A & B 22,23,24)
14:30-15:00	Break
15:00-16:00	Track Sessions (A & B 25,26)
16:30-17:00	Best Paper Award Presentation and Wrap up
17:00	Symposium Adjourned

Tuesday October 25

07:30-08:30 Check-In - Continental Breakfast
08:30-09:00 Welcome

9:00-10:00 Keynote Presentation
**Command and Control in a Digitally Enabled Operational Environment
Brigadier-général Stephane Boivin
Commander, 2nd Canadian Division and Joint Task Force (East)**

10:00-10:30 Break

10:30-11:00 Plenary Presentation
Track Chair Previews

11:00-12:00 Track 5 Sessions A1 and A2

(56)   Suzanne Waldman and Sean Havel

Updating the Concept and Execution of Narrative-Led
Operations

(8)   Zachary P. Devereaux, Bruce Forrester, Régine Lecocq, Patrick Cinq-Mars,
Marc-André Labrie

Position Paper: expanding deception detection in social media
from a military perspective

12:00-13:00 Lunch

Tuesday October 25

11:00-12:00 Track 2 Sessions B1 and B2

(5)   Jahangir H. Sarker and Ahmed Ghanmi

Machine Learning Empowered LoRaWAN for Command and Control (C2) Agility

(7)   Martin Schüler and Erik Bjurström

Blurring the lines: Merging aspects of human cognition and artificial intelligence

12:00-13:00 Lunch

Tuesday October 25

13:00-14:30 Track 5 Sessions A3, A4, A5

(28) Javan de Oliveira Cruz, Paulo César Prandel, Marcio de Carvalho Victorino, Edison Ishikawa

An information architecture supported by ontologies to provide reporting of incidents related to public safety

(35) Jonas Herkevall and Björn J E Johansson

Can crisis management be seen as harmonization of efforts?

(37) Marie-Eve Jobidon, David Bryant, Graham M. Davies, Ralph Dekker, Paul Gaertner, Magdalena Granåsen, Bruce Hardie, Peter Houghton, Alexander Kalloniatis, Per Wikberg, Maria Wikström

Implications of Future Security Environment Trends on C2 Governance

14:30-15:00 Break

15:00-17:30 Track 5 Sessions A6, A7, A8, A9, A10

(61) Matt Offord

Agent Based Modelling to demonstrate self-synchronisation at the Battle of Trafalgar: a demonstration of computational methods for teaching Command and Control

(15) Dr. Jamal Rorie, Dr. Benjamin Michlin, Mr. Josh Duclos, Mr. Dean Lee, Mr. Gary Williams

Readiness Predictions for the MH-60 Seahawk with the Digital Aviation Readiness Technology Engine

(23) Bjørn Tallak Bakken, Inger Lund-Kordahl, Ina Sandberg

Augmented and Virtual Reality (AR/VR) and Artificial Intelligence (AI) Technology in Systematic Inter-Professional Crisis Management Training

(34) Anne-Claire Boury Brisset

Robust and Trusted Artificial Intelligence through Refined Processes and Metrics for Military Applications

(D) Track 5 Discussion Session

17:30-19:00 Reception

Tuesday October 25

13:00-14:30 Track 2 Session B3, Track 8 Session B4 Track 3 Session B5

(12)   Maxwell Dondo and Natalie Nakhla

An integrated framework and taxonomy for cyber damage assessment

(63)   Dr. Paul Shigley, Jose Carreno, George Galdorisi, Clare Morton, Robert Tanner

Focus on Commander's Intent to Improve C2

(6)   Sigmund Valaker, Rune Stensrud, Arne Cato Jenssen, Walther Åsen, Astri Maria Ravnå Nyaas, Tarjei Andersen

Shifting between coordination forms: The role of competencies and organizational structure

14:30-15:00 Break

15:00-17:30 Track 3 Sessions B6, B7, B8, B9, B10

(65)   Isabelle Turcotte, Marie-Eve Jobidon, Philip Farrell, Sébastien Tremblay

The C2 Agility Model in a Crisis Management Situation: An Empirical Test

(13)   Andrew Leggatt, Chris Baber, Simon Attfield, Shailey Minocha, Emmeline Elliott, Bob Fields, Rob Hutton, Peter Cowell-Smith, Steve McNeillie

Assessing Distributed Sensemaking Performance in Command and Control: Results from an Exploratory Study

(54)   Darius E. Jefferson II and Andre V. Harrison

Baseline Assessment of Object Detection Models on Partially Occluded Objects and their Parts

(48)   Gordon Niven and Lt Gen Sir David Capewell (rtd)

The Variety Calculus Planning Methodology – An alternative planning concept for complex operations

(D)   Track 3 Discussion Session

17:30-19:00 Reception

Wednesday October 26

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

08:30- 9:00 Reflections

9:00-10:00 Keynote Presentation
Cyber Warfare Analysis Challenges
Mr. John Garstka, Director Cyber Warfare, US OSD

10:00-10:30 Break

10:30-12:00 Track 5 Sessions A11, A12, A13

(24)   Theresa Chadwick, James Chao, Christianne Izumigawa, George Galdorisi,
Héctor Ortiz-Peña, Elias Loup, Nicholas Soultanian, Mitch Manzanares, Adrian Mai,
Richmond Yen, Douglas S. Lange

Characterizing Novelty in the Military Domain

(11)   Mohamed Abdelazez and Ahmed Ghanmi

Security First Approach for Developing Machine Learning
Applications in Multi-Domain Operations

(36)   Diana Saleh, Anna Pestrea, Björn JE Johansson

Exploring Command and Control of Autonomous Units: Co-
constructing the future battlefield using a tactical board game

12:00-13:00 Lunch

Wednesday October 26

10:30-12:00 Track 6 Sessions B11, B12, B13

(14)   Marco Manso, Barbara Guerra, Janusz Furtak, Frank T. Johnsen,
        James Michaelis, Nirajan Suri, Konrad Wrona, Daniel Ota

        **C2 and IoT Systems Interoperability in Federated Environments:
        Multinational Experimentation Design**

(38)   Tomás de A. T. Botelho, Edmundo L. Cecílio, Anderson Ferreira de Oliveira

        Tactical Data Link Interoperability: MDLP Phase 2

(47)   Jonathan E. Czarnecki

        **Pulse and Pace: Two Desirable Attributes Extending Legacy
        Systems Effectiveness**

12:00-13:00 Lunch

Wednesday October 26

13:00-14:30 Track 5 Sessions A14, A15, A16

(50)   Jonathan Cawalla and Hans-Christian Schmitz

Graph-based Representation of Military Action Spaces

(31)   Rune Langleite, Eirik Anette Flynn Opland, Frank T. Johnsen

Big Data Solutions on Tactical Infrastructure

(10)   Dragos Calitoiu and Ahmed Ghanmi

Formal intelligence produced by mathematical deductive reasoning as a complement to knowledge produced by inductive inference from patterns in data (machine learning)

14:30-15:00 Break

15:00-16:00 Track 5 Sessions A17, A18

(60)   Robert R. Hoffman, Mohammadreza Jalaeian, Gary Klein, Florian Jentsch, William J. Clancey, Shane T. Mueller

Top Ten Recommendations for the Development and Assessment of AI Systems

(D)   Track 5 Discussion

16:15 Bus leaves for Tour-Dinner (optional)

Wednesday October 26

13:00-14:30 Track 6 Sessions B14, B15 Track 7 Session B16

(52) Nicolai Vatne, Carsten Griwodz, Frank T. Johnsen

Edge computing for disaster relief operations

(D) Track 6 Discussion

(59) Richard Ellis, Paul Wise, Dr Jim Hill

Development and Deployment of a Headquarters Maturity
Model - A Case Study

14:30-15:00 Break

15:00-16:00 Track 7 Sessions B17, B18

(30) Wesley McTernan, Alex Kalloniatis, Sebastian Tsui

MURA Snapshot: Development of a Sociotechnical Survey Tool for
Headquarters Assessment

(20) Daniel Salmond

Information Theoretic Measures for Command and Control:
Influenceability, Understanding and Intentionality

16:15 Bus leaves for Tour-Dinner (optional)

Thrusday October 26

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

08:30- 9:00 Reflections

9:00-10:00 Panel
C2 Resilience in sub-Threshold Warfare
Chair: Dr. Paul Gartner

10:00-10:30 Break

10:30-12:00 Track 8 Sessions A19, A20, A21

(17)   Natalia Derbentseva

Procedural knowledge loss due to military posting cycles: The need for better understanding its impact on organizational performance

(33)   Sebastian Stucken, Piro Lena, Michael Gerz, Nico Bau

Bi-Temporality in a Military Information Model

(26)   Timothy McLennan-Smith, Phuong La, Alexander Kalloniatis

Shaping Partner Battle Rhythm Design through Visualisation

12:00-13:00 Lunch

Thrusday October 26

10:30-12:00 Track 7 Sessions B19, B20, B21

(55)   Ulrik Spak and Isabell Andersson

Modelling command and control: transferring features of the individual to the organization

(27)   Niels Alston, Alexander Kalloniatis, Cameron Bowles

Augmented C2 Efficacy Assessment Using Digital Data

(39)   Justine Caylor and Adrienne Raglin

Multi-Criteria Decision Making for Uncertainty of Information

12:00-13:00 Lunch

Thursday October 26

13:00-14:30 Track 8 Sessions A22, A23, A24

(25) Scott Fang, Shadi Ghajar-Khosravi, Geoffrey Ho, Vladimir
Zotov, Robert Collins, Ming Hou

A Human Factors Perspective on Information Fusion, Data
Analytics and Decision Support for Command-and-Control
Modernization Concepts

(9) Mark E Tillman

Agile C2 Inspired Approaches: Bridging Theory to Practice

(42) Keith Stewart

Continuing the debate on Russian command approach: Are we
seeing a mission command approach?

14:30-15:00 Break

15:00-16:00 Track 8 Sessions A25, A26

(D) Track 8 Discussion

16:00 Best Paper Award and Wrap up

Symposium Adjourned

Thursday October 26

13:00-14:30 Track 7 Sessions B22, B23, B24

(4)   Martin Schüler

Planning for Safety when Preparing for War:
Competition Brings Out the Wickedness of the Military

(53)   Patrick Turner, Andrew Leggatt, Gary Smith

Bridging the gap between desktop-based C2 research and large-scale C2 experimentation

(19)   Jerzy Jarmasz, Michael Thomson, Jonathan Fugelsang, Evan Risko

A Data Collection Approach for Evaluating National Security Collective Training Events

14:30-15:00 Break

15:00-16:00 Track 7 Sessions B25, B26

(22)   Nico Bau, Jonathan Cawalla, Fahrettin Gökgöz, Manisha
Panda, Hans-Christian Schmitz, Sebastian Stucken

Intelligent Situational Awareness: Experimental Framework for Command and Control Technology

(D)   Track 7 Discussion

16:00 Best Paper Award and Wrap up

Symposium Adjourned

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.