

28th INTERNATIONAL
COMMAND AND CONTROL
RESEARCH & TECHNOLOGY SYMPOSIUM
28-30 NOVEMBER - LAUREL, MARYLAND, USA

2023

Symposium Program

Theme:

Drivers of Future C2

Hosted by



Symposium Chair

David S. Alberts



International Command and Control Institute

Tracks

Track 1: Collective C2-Harmonization

Track 2: Cyberspace

Topic 3: Uncertainty, Constraints, and Risk in
Complex Military Operations

Topic 4: Non-Human 'Intelligent' Collaboration and
Autonomous Systems

Topic 5: Emerging Concepts and Theories

Topic 6: C2 and Cyber Analytic Ecosystem

Topic 7: Other C2-related Research and Analysis

Day 1 - November 28th				
Time	Lobby	Room A	Room B	
7:30am				Registration and Check In Continental Breakfast
8:00am				
8:30am		Welcome		
9:00am		Track Session Overview		
09:30am		T5-005	T3-032	
10:00am		T5-041	T3-010 T3-046	
10:30am		Break		
11:00am		T5-060	T3-051	
11:30am		T5-028	T3-081	
		T5 Discussion	T3 045	
noon		Lunch		
1:00pm		T5-012 T5-017	T3 Discussion	
1:30pm		T5-058	T1-022	
2:00pm		T5-070	T1-025	
2:30pm		Break		
3:00pm		Keynote Lynn Reggia and Dr. David Helmer JHU APL		
3:30pm		T5-026	T1-009	
4:00pm		T5-059	T1-050	
4:30pm		T5-018	T1-004	
5:00pm		T5 Discussion	T1 Discussion	
5:30-7:00pm Reception				

Day 2 - November 29th				
Time	Lobby	Room A	Room B	
8:00am				Registration and Check In Continental Breakfast
8:30am		Reflections		
9:00am		T5-061	T1-016	
9:30am		T5-063	T1-029	
10:00am		T5-006	T1-030	
10:30am		Break		
11:00am		T5-023	T1-044	
11:30am		T5 Discussion	T1-047	
noon		Lunch		
1:00pm		Keynote Mr. John Garstka Director, Cyber Warfare US OSD		
1:30pm		Break		
2:00pm		T6-001	T1-057	
2:30pm		T6-034	T1 072 T1-068	
3:00pm		T6-066	T1 Discussion	
3:30pm		T6-065		
4:00pm		T6 Workshop		
4:30pm				
5:00pm Day 2 Adjourned				

Day 3 - November 30th				
Time	Lobby	Room A	Room B	
8:00am				Registration and Check In Continental Breakfast
8:30am		Reflections		
9:00am		Keynote RADM (ret.)Jefferey Scheidt fmr. Deputy Cyber Advisor to SECDEF US DoD		
9:30am		Break		
10:00am		T4-038	T7-002	
10:30am		T4-011	T7-042	
11:00am		T4-003	T7-039	
11:30am		T4-033	T7 Discussion	
noon		Lunch		
1:00pm		T4-043	T2-027	
1:30pm		T4-048	T2-035	
2:00pm		T4-052	T2-080	
2:30pm		T4-053	T2 Discussion	
		Break		
3:00pm		Best Paper Award and Symposium Wrap-up		
4:00pm Symposium Adjourned				

Tuesday November 28

07:30-08:30	Check-In: Continental Breakfast	
08:30-09:00	Welcome	ROOM 1
09:00-09:30	Track Session Overviews	ROOM 1

09:30-10:30 Track 5		ROOM 1
(005)	AI Simulations and MILDEC Zachary P Devereaux, Regine Lecocq, Bruce Forrester, Marc-Andre Labrie	
(041)	Cross Layer Optimization in Tactical Networks: Multi-agent Deep Reinforcement Learning Thies Möhlenhof, Norman Jansen, Wiam Rachid	
10:30-11:00 Break		
11:00-12:00 Track 5		ROOM 1
(060)	Data Quality And Analysts' Role In AI Enhanced C2 Erik Bjurström	
(028)	Anomalous Event Detection with Sparse, Event-driven Time Series Data Jamal Rorie, Dean Lee, Andrew Sabater	
	Track 5 Discussion	

12:00-13:00 Lunch

Tuesday November 28

07:30-08:30	Check-In: Continental Breakfast	
08:30-09:00	Welcome	ROOM 1
09:00-09:30	Track Session Overviews	ROOM 1

09:30-10:30 Track 3		ROOM 2
(032)	Endeavor Complexity Across Command Levels: Defining and Communicating Attributes of An Endeavor Sigmund Valaker, Rune Stensrud, Else Helene Feet	
(010)	The Future of Command and Control – Evolution or Revolution? Gordon Niven and David Capewell	
(046)	A New Perspective on the C2 Maturity Model Approach Space Marie-Eve Jobidon and Phillip S. E. Farrell	
10:30-11:00 Break		
11:00-12:00 Track 3		ROOM 2
(051)	Adaptability of CV Systems at the Tactical Edge: Addressing Environmental Uncertainty Hayden Moore	
(081)	A Set-based Approach: Unlocking Requisite Agility Through Flexecution Johan Ivvari and Annette Nolan	
(045)	Variety Versus Speed: How Variety in Competence Within Teams May Affect Performance in a Dynamic Decision-making Task Ulrik Spak and Isabell Andersson	
12:00-13:00 Lunch		

Tuesday November 28

13:00-14:30 Track 5		ROOM 1
(012)	Decision Support for Commanders: An AI Approach to Wargaming Mohamad Abdelazez, Richard Garber, Ahmed Ghanmi	
(017)	A Game Theoretic Approach to Adversarial C2 for Swarms Takuma Adams and Timothy McLennan-Smith	
(058)	Challenges to Governing C2 Lifecycle Capability Alexander Kalloniatis, Per Wikberg, Paul Gaertner, Marie-Eve Jobidon, Rich Cooke, David Bryant, Maria Wikstrom, R.A. Dekker, Jonas Herkevall, Magdalena Granasen, Peter Houghton	
(070)	The Sweet Spot: Between Agility and Standardization Bjorn Johansson, Alexander Kalloniatis, Jonas Herkevall, Magdalena Granasen	
14:30-15:00 Break		
15:00-16:00 Keynote Presentation		ROOM 1
AI and the Human in Command and Control Lynn Reggia and Dr. David Helmer, JHUAPL		
16:00-17:30 Track 5		ROOM 1
(026)	Autonomous Information Processing At The Tactical Level Rune Langleite, Emil P. Andersen, Anette F. Opland, and Frank T. Johnsen	
(059)	Case Study In Transforming C2: Australia And Plan MURA, An Update Alexander Kalloniatis and Paul Gaertner	
(018)	Navigating In the Zoo Martin Schüler and Erik Bjurström	
	Track 5 Discussion	

17:30-19:00	Reception
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Tuesday November 28

13:00	Track 3 Discussion
13:30-14:30 Track 1	
ROOM 2	
(022)	Organizational Structure and Consensus Emergence of Team Trust Perceptions within Command and Control (C2) Systems Michael T. Chapman, Julien Corsin, Micah Wilson, Luke Strickland Mengbin Ye, Carly Brade, Mark Griffin, Marylene Gagne, Karina Jorritsma, Tom Gedeon. Daniel F. Gucciardi
(025)	Coalface Perspectives on C2 Capability Governance: An Interview Study Dr. Per Wikberg, Maj. Ralph. Dekker, Ms. Magdalena Granåsen. Jonas Herkevall, Dr. David Bryant, Mr. Rich Cooke, Dr. Paul Gaertner, Dr. Marie-Eve Jobidon, Dr. Alexander Kalloniatis
14:30-15:00 Break	
15:00-16:00 Keynote Presentation	
ROOM 1	
AI and the Human in Command and Control Lynn Reggia and Dr. David Helmer, JHUAPL	
16:00-17:30 Track 1	
ROOM 2	
(009)	The Anatomy of Command and Control: a Generic Functional Model Gordon Niven
(050)	Team Up for Success Harnessing Participatory Sense-making with the Harmonization Emergence Model Johan Ivvari and Annette Nolan
(004)	Applying a Mission-Engineering Thread Approach Using Sense-Decide-Effect to the Problem of a Common C2 System for UxS John O'Neill, Joshua McDonald, SGNLDR Ben Heaton
	Track 1 Discussion

17:30-19:00	Reception
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Wednesday November 29

08:00-08:30	Check-In: Continental Breakfast	
08:30-09:00	Reflections	ROOM 1

09:30-10:30 Track 5		ROOM 1
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(061)	A Framework for Understanding the Relationship Between C2 Theories, Military Long-Term Planning, and Empirical Studies Björn Johansson, Jonas Herkevall, Mats Lantz
(063)	Adapting to Novelty Will Drive Future Operations Theresa Chadwick, James Chao, Christianne Izumigawa, Mitch Manzanares, Nicholas Soutanian, Douglas S. Lange
(006)	Artificial Reasoning Approach Utilizing Pharmacological Computational Model Information Mapping Adrienne Raglin, Dawn A. Lott, Somiya Metu

10:30-11:00 Break	
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11:00-12:00 Track 5		ROOM 1
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(023)	Network Flow Interdiction for Graph-based Course of Action Analysis Jonathan Cawalla and Hans-Christian Schmitz
	Track 5 Discussion

12:00-13:00 Lunch	
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Wednesday November 29

08:00-08:30	Check-In: Continental Breakfast	
08:30-09:00	Reflections	ROOM 1

09:00-10:30 Track 1		ROOM 2
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(016)	Multi-Domain Targeting through Battle Rhythm Modelling for Superior Decision Making Takuma Adams, Jeffrey Davis, Michael Francis
(029)	Dynamic Effects of Social Media Information on Command and Control Performance Xinyun Hu, Linh Bui, Guihyun Park, Penny Sweetser, Wesley McTernan, Samantha Stanley, Eryn Newman, Sabrina Caldwell
(030)	MURA Snapshot Survey: Validation of Culture and C2 Agility Scales Rachel Mate and Wesley McTernan

10:30-11:00 Break	
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11:00-12:00 Track 1		ROOM 2
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(044)	A Future C2 Concept Designed to Guide Capability Development Magdalena Granåsen, Niklas Hallberg, Anders Josefsson and Johan Ivar
(047)	Exploring the Effects of Future Technologies on C2 Magdalena Granåsen, Jonas Herkevall, Gustav Tolt, Björn Johansson

12:00-13:00 Lunch	
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Wednesday November 29

13:00-14:00 Keynote Presentation		ROOM 1
Cyber Risk to Mission Mr. John Garstka, Director, Cyber Warfare, US OSD		
14:00-14:30 Break		
14:30-17:00 Track 6		ROOM 1
(001)	Cyber Warfare Metrics David S. Alberts	
(034)	Virtual Testbed for Cost-Effective Evaluation of C2 Systems: Practical Examples from the Swedish Armed Forces Pär-Anders Albinsson, Dennis Granåsen, Jonas Hermelin, Mirko Thorstensson	
(066)	Integrating Wargaming into the Canadian Operational Planning Process: An Experimental Approach Sean Havel	
(065)	Experiments on C2 and IoT Technical Interoperability in Tactical Federated Environments Marco Manso, Janusz Furtak, Barbara Guerra, Frank T. Johnsen James Michaelis, Daniel Ota, Niranjan Suri, Konrad Wrona	
	Track 6 Workshop	
17:00 Day 2 Adjourned		

Wednesday November 29

13:00-14:00 Keynote Presentation		ROOM 1
Cyber Risk to Mission Mr. John Garstka, Director, Cyber Warfare, US OSD		
14:00-14:30 Break		
14:30-17:00 Track 1		ROOM 2
(057)	Modelling Multi-Domain C2 With Network Synchronisation: Testing a NATO-SAS-143 Hypothesis Alexander Kalloniatis	
(068)	What Mission Command is Not Murat Balci	
	Track 1 Discussion	

17:00 Day 2 Adjourned

Thursday November 30

08:00-08:30	Check-In: Continental Breakfast
08:30-09:00	Reflections ROOM 1

09:00-10:00 Keynote Presentation	ROOM 1
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<p>Generating Ready and Resilient Command and Control RADM (ret.) Jefferey Scheidt, fmr. Deputy Cyber Advisor to SECDEF, DoD</p>
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10:00-10:30 Break

10:30-12:00 Track 4	ROOM 1
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(038)	<p>Constructing a Game of Games to Expedite Command and Control Capability Development Carter Veldhuizen, Michael Czajkowski, Jinhong K. Guo, Matthew Widjaja</p>
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(003)	<p>The Concept of Non-Human Intelligent Cooperation with No Inter-Communication: Goore Game for Centralized Command and Distributed Control of Sensors Dragos Calitoiu and Ahmed Ghanmi</p>
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(011)	<p>SPRITE: A Plan Template Learning Framework Melinda Gervasio, Karen Myers, Laura Tam, Christian Szatkowski</p>
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(033)	<p>Hybrid Cognitive Capabilities in EDGE Operations Arne Norlander - not presented</p>
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12:00-13:00 Lunch

Thursday November 30

08:00-08:30	Check-In: Continental Breakfast	
08:30-09:00	Reflections	ROOM 1

09:00-10:00 Keynote Presentation		ROOM 1
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Generating Ready and Resilient Command and Control

RADM (ret.) Jefferey Scheidt, fmr. Deputy Cyber Advisor to SECDEF, DoD

14:00-14:30 Break

14:30-17:00 Track 7		ROOM 2
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(002)	Censeo: A Scenario-based Approach to C2 Capability Assessment and Experimentation Brian Krisler, John Myers, Colleen Rock, Jeff Miller
(042)	Acquisition Management as Mission Command: C2 Systems Acquisition Reimagined Johan Nordström, Susanna Nilsson, Jonas Herkevall
(039)	Methodology for Assessment of C2-systems: A Literature Review Per-Anders Oskarsson, Charlotte Stenius, Alexander Melbi
	Track 7 Discussion

12:00-13:00 Lunch

Thursday November 30

13:00-14:30 Track 4		ROOM 1
(043)	Bridging the Gap between Humans and AI in Military Planning: Officers' Response to a Text-Based AI Assistant Victor Lindholm, Zackarias Alenljung, Johan Karlsson	
(048)	Towards a Layered Architecture for Adaptive Autonomy in Human-Robotic Team Interaction Mark Allison, Alice Gaspard, Max Parks, Felicia Jefferson - not presented	
(049)	A Persistent Leadership Structure for Heterogeneous Robotic Teams Mark Allison, Jacob Duncan, Alice Gaspard - not presented	
(052)	A Utilitarian Approach to the Structure of Human-AI Teams Thom Hawkins, Daniel N. Cassenti	
(053)	AI in Future C2 – Who's in Command When AI Takes Control? Bjørn Tallak Bakken, Inger Lund-Kordahl, Erik Bjurström	
	Track 4 Discussion	
14:30-15:00 Break		
15:00 Best Paper Award and Wrap up		

1530 Symposium Adjourned

Thursday November 30

13:00-14:30 Track 2		ROOM 2
(027)	Using C2 Problem Space to Integrate Cyber and Kinetic Operations Tim Grant	
(035)	Cyberspace Operations Ken Teske	
(080)	Defining Cyber Warfare Capability Attributes and Characteristics for African Cyber Missions Mphahlela Thaba and Jabu Mtsweni	
	Track 2 Discussion	
14:30-15:00 Break		
15:00 Best Paper Award and Wrap up		

1530 Symposium Adjourned



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 sociotechnical 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 25 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.