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# Common Topics in Command & Control for EM

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# Overview



- Goal:
  - To identify common topics in existing C2 doctrine for Emergency Management (EM)
- Overview:
  - Introduction & motivation
  - Relevant theory
  - Survey: methodology & sources
  - Survey: results & discussion
  - Conclusions & further research

# Introduction: about me (1/2)



- Career:
  - 1966-87: Royal Air Force officer (UK & SG)
  - 1987-2004: Consultant, ICT services industry (NL)
  - 2001-09: Visiting Professor, University of Pretoria (ZA)
  - 2004-12: Professor, Netherlands Defence Academy (NL)
  - 2012- : Professor emeritus & Founder, R-BAR (NL)
- Current lines of research:
  - C2 theory:
    - Information sharing in coalition C2: 2 PhD students
  - Simulating cultural diversity in coalition C2
  - Offensive cyber operations (esp. counter-attack)

# Introduction: about me (2/2)



*I come from Stokes Valley:*

No.	CHLD.	
	1. When born. 2. Where born.	Christian or First Names (only).
(1)	(2)	(3)
1816	(1) 18 June, 1947.	Timothy John.
	(2) "La Kalinda", Main Road, Stokes Valley.	

*RNZAF Bristol Freighter over Singapore:*



# Motivation



- C2 literature:
  - ISCRAM & ICCRTS conference proceedings
  - Around dozen books, but no textbook:
    - AFCEA Press, CCRP (US DoD), Francis & Taylor
  - I'm scoping proposed C2 textbook:
    - Covering military, EM, & utilities (eg electricity, water, oil & gas, telecoms)
    - Aimed at military, police, firefighter, medical, etc students (Ba/BSc & Ma/MSc)
- C2 textbook structure:
  - Part 0. Introduction
  - Part 1. C2 doctrine ← *Scoped in this paper (& military C2 sister study)*
  - Part 2. C2 theory ← *Scoped in ISCRAM 2017 paper*
  - Part 3. C2 case studies
  - Part 4. Future C2 developments

# Relevant theory (1/3)



- Command & Control (C2):
  - *Command*: “Creative expression of human will necessary to accomplish mission”
  - *Control*: “The structures and processes devised by Command to enable it and to manage risk”

- Doctrine:

Pigeau & McCann, 2002

- Definitions:

- “Set of beliefs held by church, political party, or other group”
    - “Stated principle of government policy”

Oxford Dictionaries, 2018

- (Semi-) formalized practitioner knowledge

- This paper focuses on:

- Doctrine in EM domain concerning C2 system & process

# Relevant theory (2/3)



- Doctrine (cont):
  - Jackson (2013) analysed doctrine of (Western) militaries:
    - *Ontology*: “set of domain concepts incl properties and relations”
    - *Epistemology*: “theory of knowledge, esp methods, validity, & scope”
  - He identified 4 schools of doctrinal ontology:

Oxford Dictionaries, 2018

School	Period	Audience & scope	Application	Relationship to ontology
1 <sup>st</sup> : Technical	1607 to 18 <sup>th</sup> century	Users of technical systems	Instruction manual	(none)
2 <sup>nd</sup> : Tactical	1779 to end Vietnam war	Student officers	Training aid	Implicit
3 <sup>rd</sup> : Operational	1982 to end Cold war	Commanders & planning staffs	Guidance	Explicit
4 <sup>th</sup> : Military strategic	1993 to present	Much broader: from single service, through other services & militaries, to general public	Instrument for analysis	Inquisitive

Jackson, 2013

# Relevant theory (3/3)



- Doctrine (cont):
  - Turning to epistemology, Jackson (2013) says:
    - For all 4 schools epistemic foundation is *positivism*:
      - Positivism = rationality & objectivity
    - *Anti-positivism* begun to influence doctrine since 2000:
      - Repeating SOPs in same circumstances yields different outcomes
      - Events only understandable to participants
    - Drawing on Bousquet's (2008) work on *chaoplexity*, doctrine is starting to stress role of intelligence & design thinking:
      - Chaoplexity = combination of chaos & complexity
    - Resilience & agility can be seen as responses to chaoplexity:
      - Resilience in EM literature, and C2 agility in military domain
    - Conclusion: 5<sup>th</sup> anti-positivist doctrinal school may be emerging



# Survey: method



- Method:
  1. Search (open source) Internet & book supplier catalogues
  2. Reject hits not in EM domain, not in English, and/or at political level
  3. Fill in questionnaire for each EM doctrine publication
  4. Analyze according to Jackson (2013) & Bousquet (2008):
    - Disaster phase, C2 level, stance, decision-making process, metaphorical technology, C2 definition, & C2 topics
  5. Compare to sister study on military C2 doctrine
  6. Propose standard ToC / curriculum for C2 doctrine

# Survey: sources



Year	Form	Nation	Domain	Reference	Title
1996	Manual	USA	Disasters	LA EOB	Disaster Response – Command & Control
2001	Book	USA	Disasters	Green	Command and Control of Disaster Operations
2002	Book	SWE	Fire & rescue	MSB	The Elements of Command and Control: The general principles of C2 in fire and rescue operations
2006	Book	USA	Medical	Rüter et al	Medical Command and Control at Incidents and Disasters
2007	Manual	DE	Disasters	DV100	Leadership and Command in Emergency Operations
2008	Manual	UK	Fire	HMG FSO	Fire & Rescue Manual, Volume 2, Fire Service Operations – Incident Command (3 <sup>rd</sup> ed)
2009	Manual	UK	Police	HMG NPIA	Guidance on Command and Control
2012	Manual	UK	Ambulance	HMG NARU	Command and Control Guidance

Common topics in C2 doctrine for EM

# Survey: results (1/3)



- Doctrinal school:

Year	Reference	Audience	Application	Ontology	School
1996	LA EOB	Commanders & staffs	Guidance	Explicit	3 <sup>rd</sup> : operational
2001	Green	Commanders & staffs	Training aid & guidance	Explicit	3 <sup>rd</sup> : operational
2002	MSB	Commanders & staffs	Guidance	Explicit	3 <sup>rd</sup> : operational
2006	Rüter et al	Commanders & staffs	Guidance	(none)	3 <sup>rd</sup> : operational
2007	DV100	Commanders & staffs	Training aid & guidance	Explicit	3 <sup>rd</sup> : operational
2008	HMG FSO	Commanders & staffs	Guidance	Explicit	3 <sup>rd</sup> : operational
2009	HMG NPIA	Commanders & staffs	Guidance	Explicit	3 <sup>rd</sup> : operational
2012	HMG NARU	Commanders & staffs	Guidance	Explicit	3 <sup>rd</sup> : operational

Common topics in C2 doctrine for EM

# Survey: results (2/3)



- Disaster phase & C2 level:
  - Respond phase in all publications
  - Tactical & (all but one) operational level of C2 in all publications
- Positivistic stance:
  - Uncertainty & tempo (in most); resilience or agility (in some)
  - Few mentioned complexity or chaos -> positivistic stance
- Decision-making process:
  - All cyclic but all different; only one from standard reference (NIH?)
- Metaphorical technology:
  - Impossible to assess
- C2 definitions:
  - All different; none from standard reference (NIH?)

# Survey: results (3/3)



- Common topics:

Entity-class	Scientific discipline	LA	Green	MSB	Rüter et al	DV100	FSO	NPIA	NARU
Person	Psychology	Yes		Yes		Yes	Yes		Yes
	Leadership	Yes		Yes	Yes	Yes	Yes	Yes	Yes
	Decision theory	Yes		Yes		Yes	Yes	Yes	Yes
Technology	Engineering	Yes	Yes		Yes			Yes	
	ICT	Yes		Yes				Yes	
Information	Information theory			Yes			Yes		Yes
	Knowledge management			Yes					
Message	Communication			Yes	Yes		Yes	Yes	Yes
Organization	Org theory	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Management	Yes	(risk)	Yes	Yes	Yes	Yes	(protocols)	(risk)
	Law & ethics		Yes		Yes	Yes			
	Political science				Yes				
State (-change)	Cybernetics / control theory	Yes		Yes		Yes			
	Geography & navigation			Yes					
	Time			Yes					
Relation	Network theory	Yes							

# Discussion (1/2)



- Top topics (EM):
  - Organization theory
  - Leadership theory
  - Decision theory
  - Psychology
  - Communication theory
  - Management theory
- Top topics (military):
  - Organization theory
  - Socio-technical systems
  - Leadership theory
  - Spectrum of approaches
  - Commander's intent
  - Technology (& esp ICT)
  - Decision theory

# Discussion (2/2)



- Standard Table of Contents for C2 doctrine:
  1. Introduction
  2. Definitions
  3. C2 process
  4. C2 socio-technical system
  5. Leadership & followership
  6. Organization & management
  7. Norms, procedures, & constraints

# Conclusions



- **Conclusions:**
  - Eight C2 doctrine publications found in open EM literature
  - Jackson (2013) used as analytical lens to find common topics
  - All 3<sup>rd</sup> doctrinal school, respond phase, & tactical level
  - Top common topics compared to sister study of military C2
    - Shared focus on organization, leadership, & decision theory
- **Contribution:**
  - Identification of common topics in C2 doctrine in EM
- **Limitations:**
  - Small set of doctrine publications in open literature
  - Desk research only



# Further work



- Further work:
  - Increase number of EM publications surveyed
  - Supplement analysis by observation, interviews, etc
  - Extend to military C2 doctrine (in progress) & C2 for utilities
  - Compare C2 definitions & decision processes in detail:
    - And look at how these are implemented in (technical) C2 systems
  - Extend doctrine to operational & technological developments
- Recommendations for C2 doctrine authors:
  - Use standard C2 definitions & decision process
  - Consider complexity & chaos, as well as uncertainty & tempo
  - Provide proven ways of enhancing resilience & agility



# Any questions?

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