



# Role Allocation and Team Structure in C2 Teams

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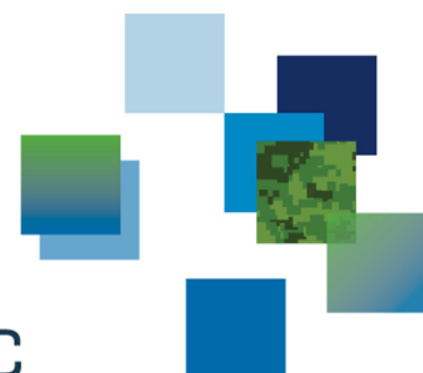
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# Overview

- Context of the study
- Command and control and team structure
- Role allocation
- Experimental design and analyses
- Results
- Conclusions

# Context of the Study – The TASSCM Project

- Tracking Agility and Self-Synchronization in Crisis Management (TASSCM) project
  - Canadian DND-Academia-Industry research partnership
- Key objectives
  - Provide systematic characterization of agility and self-synchronization in teamwork
  - Enable and capture self-organizing behaviours



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# Crisis Management Teams

- Defence and security environments are increasingly uncertain and dynamic
  - C2 must be adaptive and agile to respond to these environments
- Traditionally in C2: Tasks, roles, and resources are clearly assigned
  - May limit teams' ability to adapt to changing demands and unexpected events
- Edge organizations (EO): Flattening and decentralization of the traditional hierarchical structure
  - Proposed as potential solution for drawbacks of functional/hierarchical structures
  - Theorized to allow greater potential for flexibility and agility

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# Role of Roles

## ■ Role allocation

- Distribution of tasks, responsibilities, and resources among team members
- Explicit role allocation is positively associated with team performance, team planning and shared situation awareness
- Closely linked to team structure: bidirectional relationship

## ■ C2 teams need to be able to adjust their roles as needed during the execution of a task

## ■ Potential issue with EO: Role ambiguity

- Lack of clarity on team roles and responsibilities can hinder performance and teamwork

## ■ Effectively balancing organizational flexibility and role ambiguity could make a military team more efficient and responsive



# Objective of the Study

- Do edge teams organize differently from functional teams?
- Do they take advantage of the flexibility afforded by the lack of structure to modify role allocation throughout various missions?

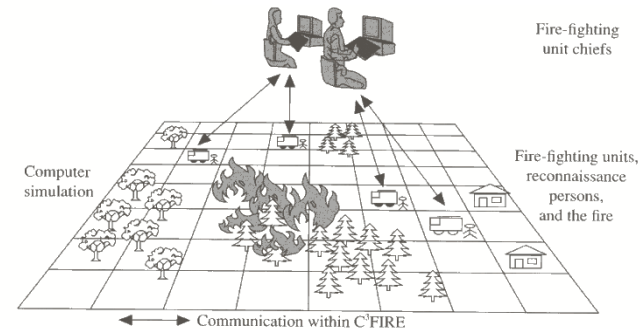




# Microworld - C3Fire (Granlund, 2002)

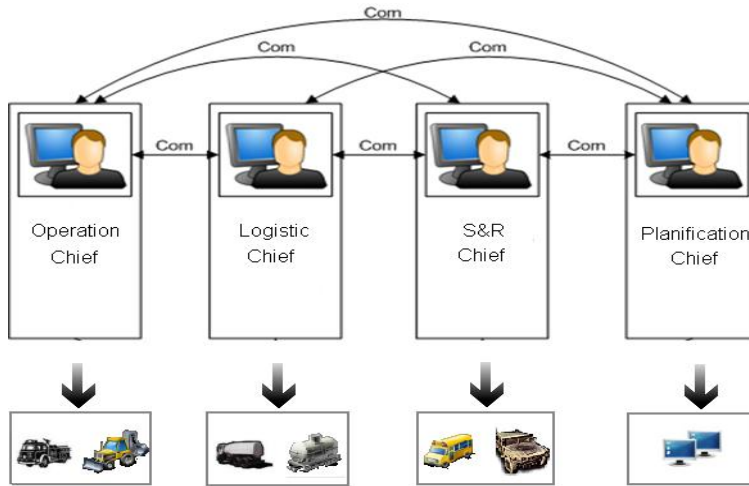


- Simulated environment of command, control and communication
- Fires spread in real time, both autonomously and as a consequence of human actions
- Teams pursue multiple objectives:
  - Limit spread of the fire
  - Protect and save houses
  - Rescue population

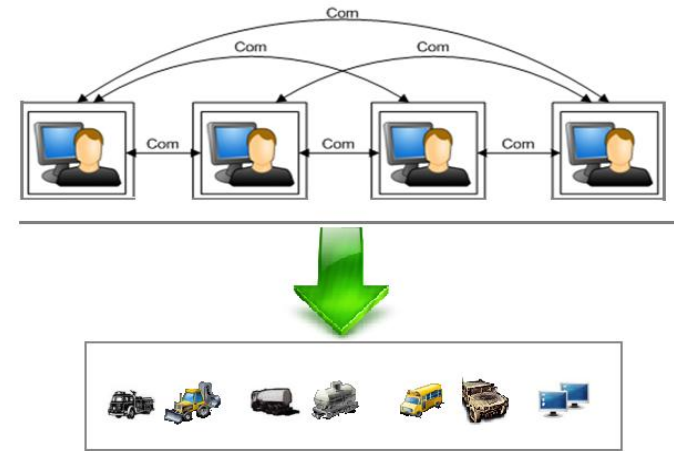


# Team Structures and Role Allocation

- 2 groups of 24 four-person teams



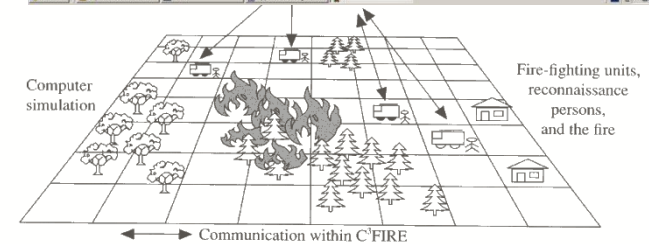
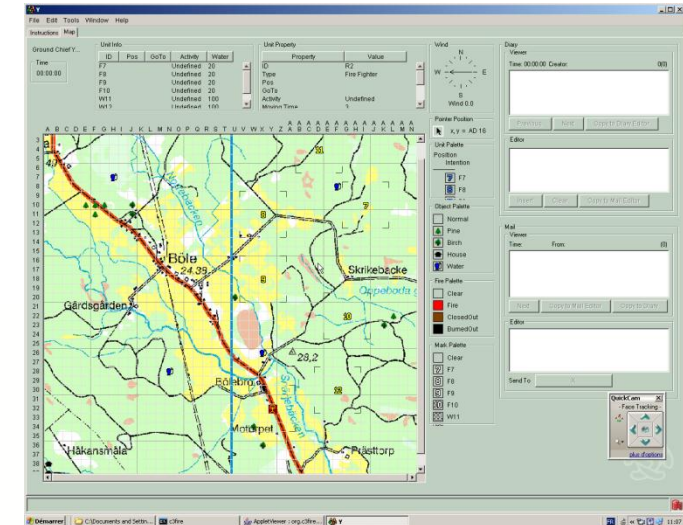
Function-based



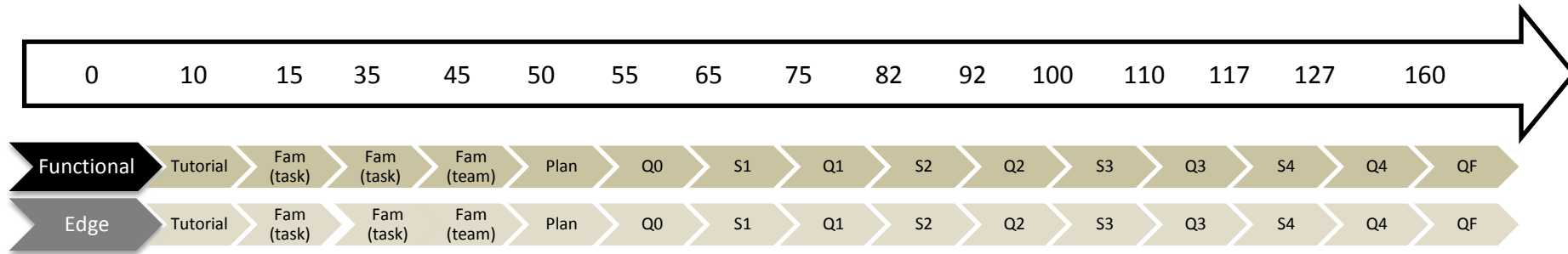
Edge

# Design: Scenarios & Stressors

- 4 scenarios with 2 stressors:
  - Workload and time pressure (high/low)
- Workload = Unforeseen event that causes sudden transitions in workload
  - Event is an unexpected 2nd fire
- Time pressure = Faster propagation
  - Changes in wind speed and direction
- Realistic scenarios, tuned for difficulty via pilot testing



# Design: Timeline



S = Scenario

Q = Post-scenario questionnaires

# Analyses – Clusters

- Behavioural indicator of roles: Proportion of use for each type of unit

$$\frac{\text{Number of times a type of unit was used by a participant}}{\text{Total number of times this type of unit was used by the team}}$$

- Role categories based on the explicit role allocation in functional condition: planning, operations, S&R, resources management
- 2-step cluster analysis
  - Step 1: Run on functional teams to confirm that team members cluster based on assigned roles
  - Step 2: Run on edge teams to determine their role allocation and how it compares to functional teams

# Results Cluster Analysis – Functional Teams

Units	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Message	.98	.00	.00	.00
Firebreaks	.00	1.00	.00	.00
Water	.00	.00	.00	1.00
Fuel	.00	.00	.00	1.00
Firefighters	.00	1.00	.00	.00
Search	.00	.00	1.00	.00
Transportation	.00	.00	1.00	.00

- Clusters represent the 4 explicit roles allocated in functional teams

# Results Cluster Analysis – Edge Teams

Units	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Message	.11	.02	.01	1.00	.05
Firebreaks	.02	.06	.90	.22	.01
Water	.37	.05	.10	.08	.75
Fuel	.05	.04	.22	.28	.78
Firefighters	.92	.03	.13	.01	.08
Search	.04	.36	.23	.56	.03
Transportation	.03	.93	.04	.17	.03

- Clusters represent a mix of roles allocated in functional teams (clusters 2 and 5) and new, edge-specific roles (clusters 1, 3, and 4)

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- Combination of operations and resources management



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- Search and rescue (similar to functional teams)

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- Combination of planning and search roles

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- Resource management (similar to functional teams)

# Discussion

- Findings reveal that overall, edge teams allocate roles differently than functional teams, and that role allocation remains relatively stable once established
- Four main findings:
  - 4 clusters emerged for functional teams, corresponding to the 4 explicit roles allocated to team members in that condition
  - In edge teams, 5 clusters emerged: 2 corresponding to functional roles and 3 edge-specific (describing different, combined, roles)
  - Team members did not significantly alter their roles in response to environmental changes (i.e., time pressure and workload)
  - Role adoption in edge teams was stable over the course of missions (only  $\approx 4\%$  change)

# Discussion

- Edge teams spontaneously adopted a set of distinct roles that only partly overlapped with the explicit functional roles (see also Duncan & Jobidon, 2008)
- Flexibility afforded by the edge structure could manifest itself 2 ways:
  - Across teams: Each team could determine its own way to coordinate tasks and units
    - Most teams adopted 4 roles (i.e., were found in four of the five clusters), creating different combinations of roles (echoes Jobidon et al., 2013)
  - Within teams: Edge teams could modify role allocation throughout missions
    - However, role adoption in edge teams was quite stable throughout scenarios



# Conclusions

- Edge teams took advantage of their flexibility
  - Some overlap with functional roles, but also adopted specific roles
- Stability of roles throughout missions suggests that members of flexible teams do not necessarily feel the need to adjust their roles just because they can do so
  - Possible that environmental changes did not warrant changes in roles
  - Possible that benefits of keeping roles were greater than the potential risks of confusion and role ambiguity within the team
- Further work
  - How does that translate in terms of team performance and coordination?



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