Exploring the Potential of Computer Games for Decentralized Command and Control

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Overview

- Decentralized Command and Control (DCC)

- *DECENT*: a prototype platform for research and experimentation with DCC

- C2 game play in DECENT

- Features in development for DECENT game play

- Extending DECENT C2 functionality

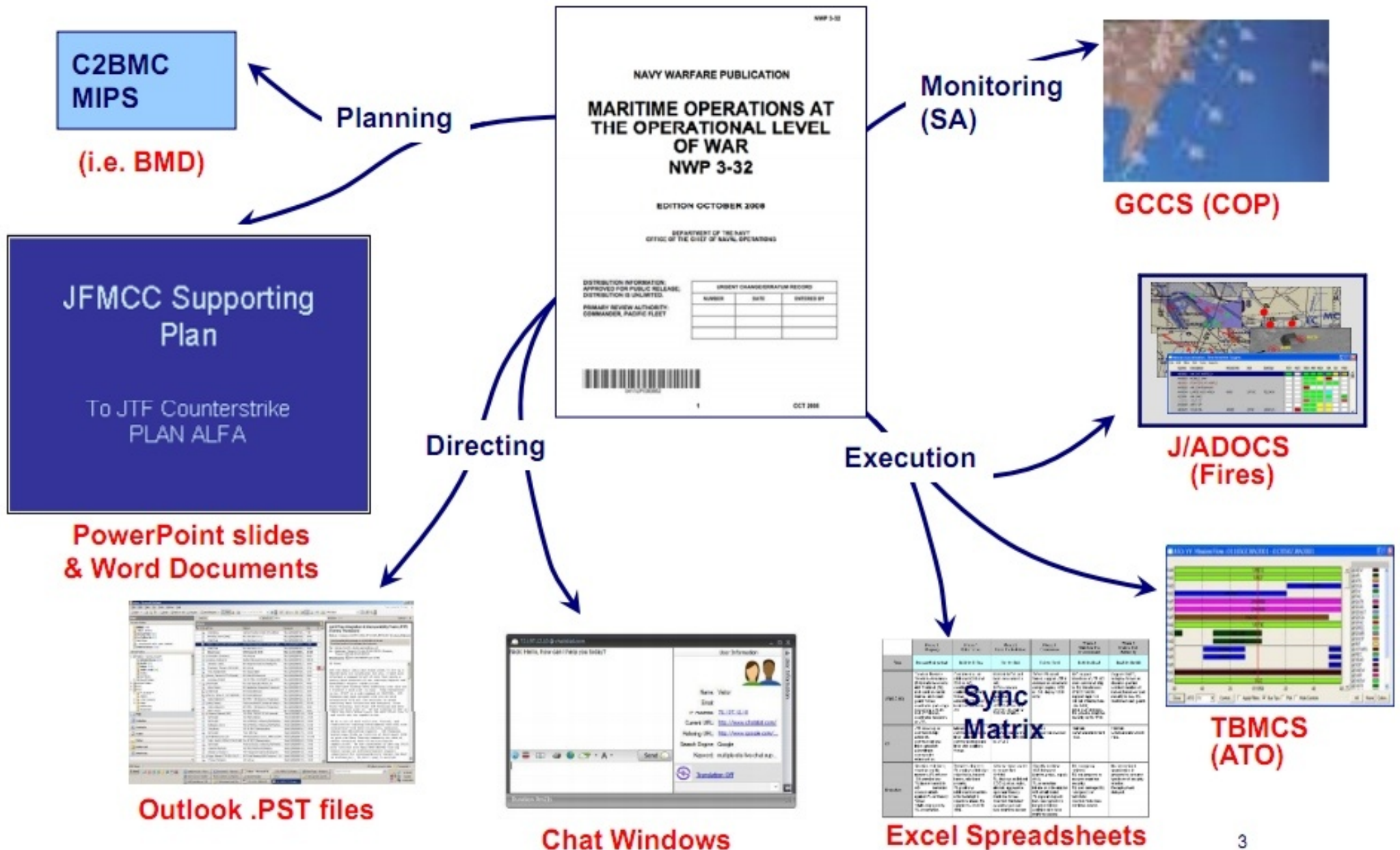- Conclusions and recommendations for future studies

Decentralized Command and Control (DCC)

- DCC emerging as a new strategic thrust [DoD JOAC 2012]

- DCC encourages physically decentralized user practices, using low-cost/open source software.

- DCC operates as a *virtual enterprise*

  - Physically distributed, logically centralized

  - "Edge" of a multi-site organization [Albert and Hayes 2003]

- DCC accommodates peer-to-peer organizational decision-making and work locations

  - Crowd-sourced DCC may also be possible

DECENT: a prototype platform for research and experimentation with DCC

- DECENT is a game-based virtual world prototype and platform for experimentation with DCC
  - VW technology for DCC [Scacchi, Brown, Nies 2012]
- Developed with low-cost, open source software for virtual worlds (OpenSim).
  - *Transformative*: Potential to dramatically reduce the cost of fielding C2 system capabilities
  - Few barriers to acquisition
  - Applicable to mission planning and coordination in physical and virtual applications (Cyberwarfare).

Current vision for advanced C2: C2RPC [2010]

C2BMC MIPS
(i.e. BMD)

Planning

NAVY WARFARE PUBLICATION

MARITIME OPERATIONS AT THE OPERATIONAL LEVEL OF WAR
NWP 3-32

Monitoring (SA)

GCCS (COP)

JFMCC Supporting Plan
To JTF Counterstrike PLAN ALFA

PowerPoint slides & Word Documents

Directing

Execution

J/ADOCS (Fires)

Outlook .PST files

Chat Windows

Sync Matrix

Excel Spreadsheets

TBMCS (ATO)

3

C2 game play in DECENT

- DECENT is a *decentralized virtual activity system* for work or play research studies [Scacchi 2010]

- Game-based virtual world (VW) modifications ("mods") by end-users can be accommodated [Scacchi 2011]

- Utilizes scalable, network-centric, client-server *hypergrid* architecture [Lopes 2011; Scacchi, Brown, Nies 2012]

  - Hypergrids allow for decentralized or isolated VWs to be integrated or interoperated via hyperlinks

  - Geographical location of participants is open

- All participants depicted within DECENT as avatars

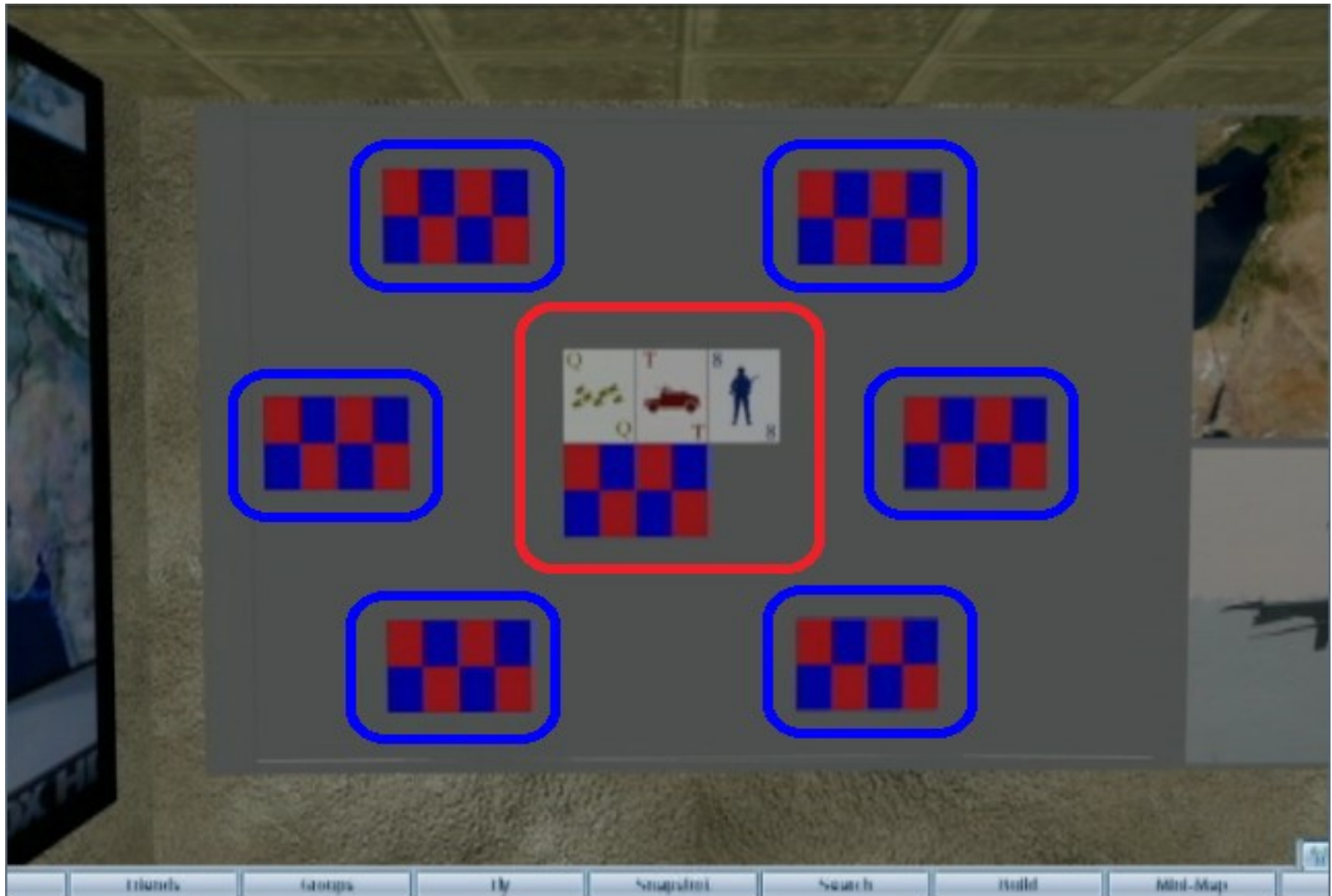- Employs *Texas Hold'em Poker* as mission planning and resource allocation game
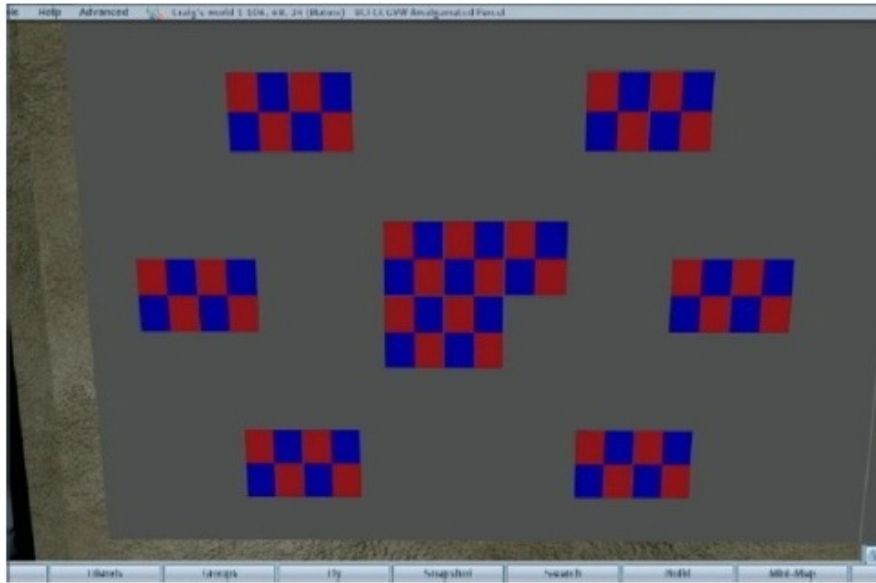
DECENT game proctor
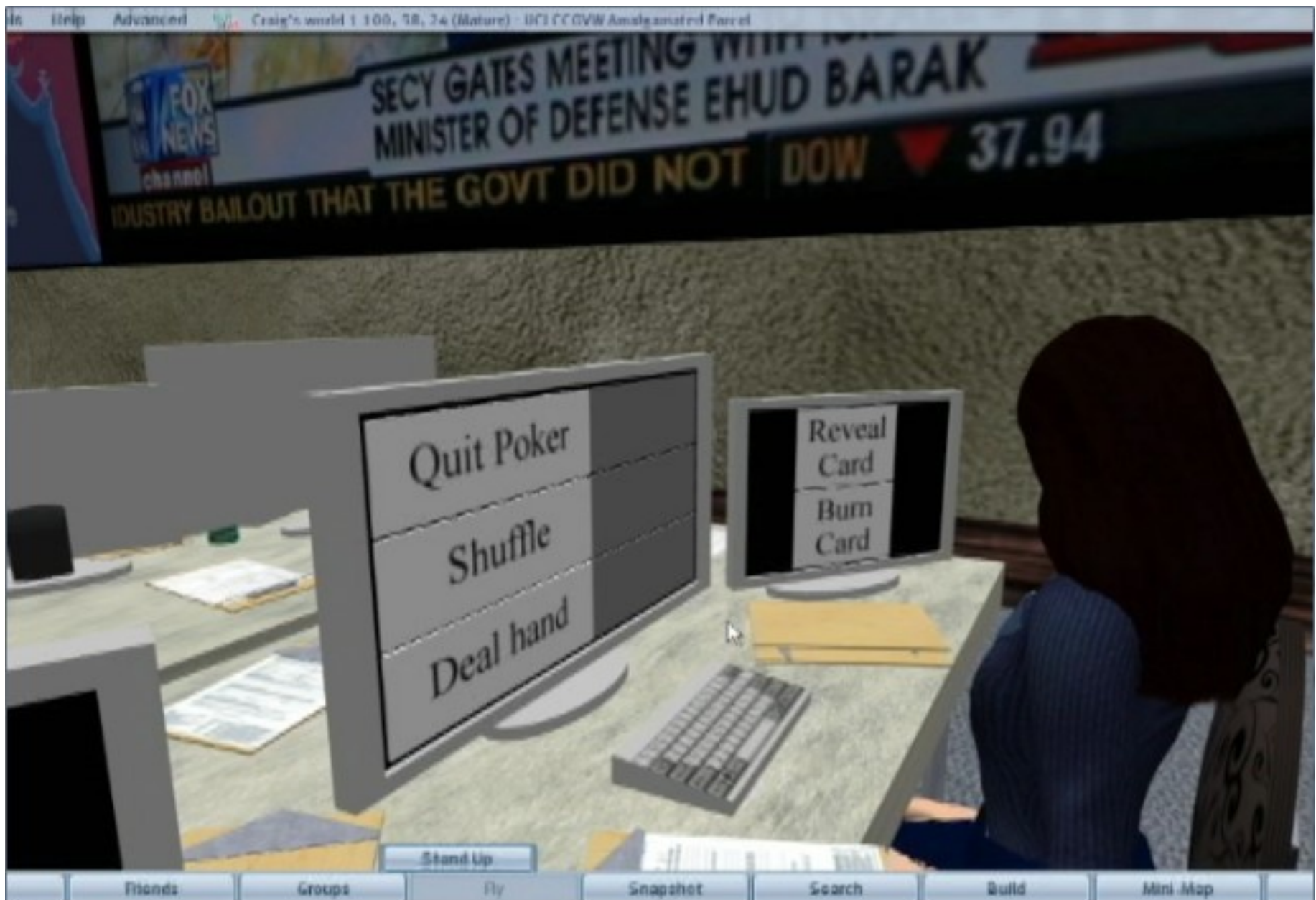
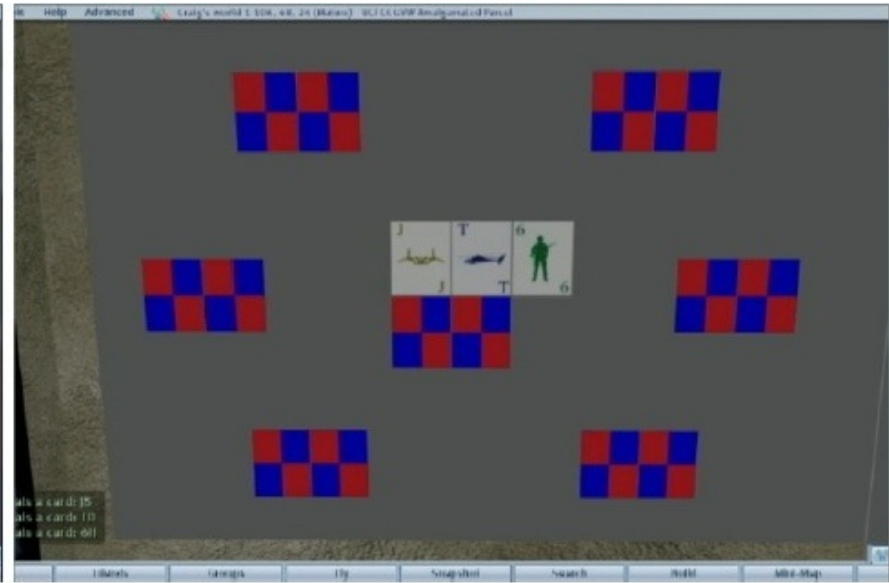# Teams discussing game play tactics

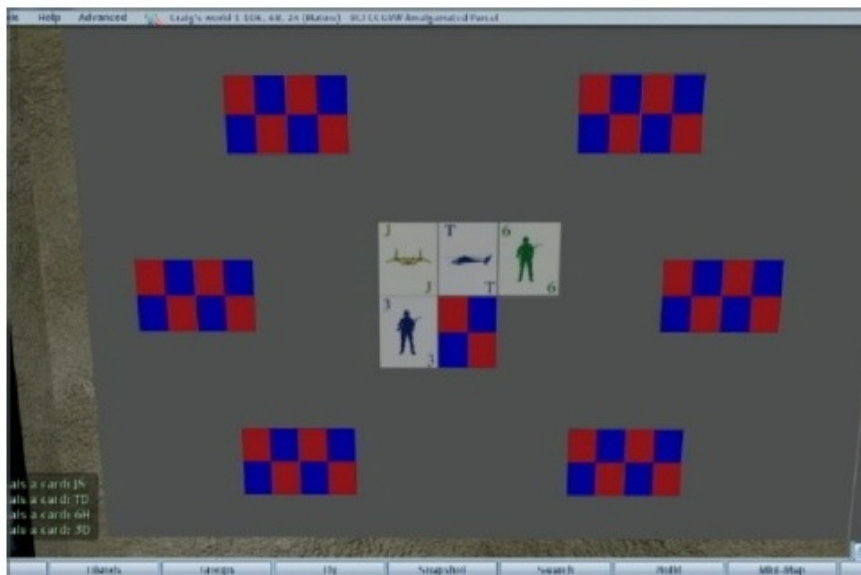# C2 mission planning game (*Texas Hold'em*)

Incremental information about different mission planning resource contingencies
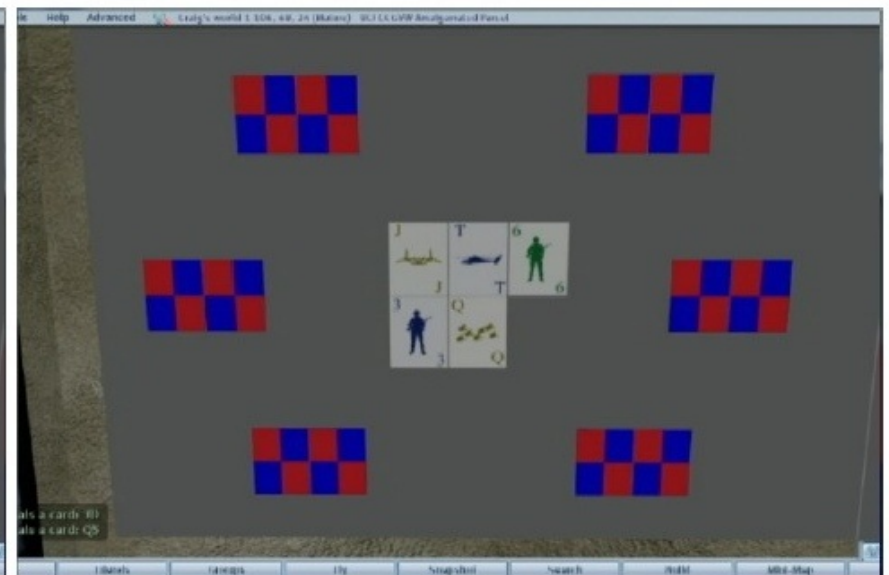

(a) Pre-flop

(b) Flop

(c) Turn

(d) River

C2 mission planning contingency card formats

- Mission Card Title
- *Flavor text,* a description of the mission
- *Rules text,* how the mission affects the game's rules
- *Image,* an image which represents the rules text

Mission contingency example

Brute force

The enemy knew we were coming, and prepared for our best. Pure numbers will win today.

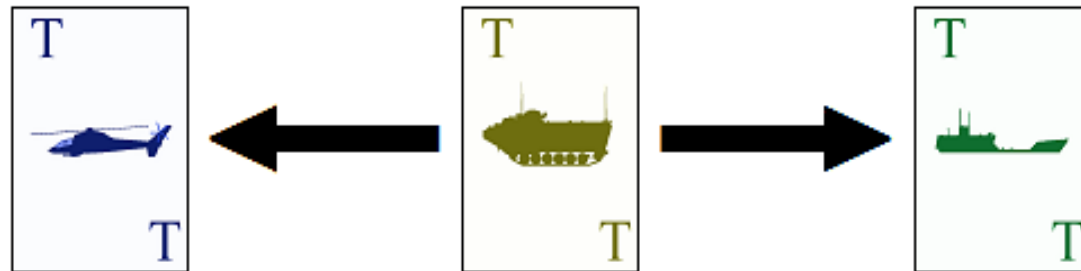Cards with values of Jack and higher cannot be played. Aces can be played with value 1.

Another mission contingency example

Borrowed Resources

One military branch is more prepared for this task than the others. Make sure that branch has everything it needs for the mission.

One hole card may be played as any suit.

Features in development for DECENT game play

- Personalize avatars associated with different C2 players [Hudson and Nissen 2010]

- DECENT prototype/concepts for different commands:

  - Large theatre command

  - Near-earth space command (NASA, USAF)

  - Other future global commands utilizing spherical information displays and *spherecasting* techniques (NOAA)

    – Global remote sensing applications (e.g., weather, climate change)

    – Interplanetary rocket launch and control command (for kids)

- Extending DECENT collaboration capabilities

Personalized DECENT avatars

Spherecasting techniques

Extending DECENT C2 functionality

- *Goal*: add support to DECENT to support a more complete range of capabilities and affordances supporting decentralized collaboration

Decentralized collaboration affordances
(+ currently supported or demonstrated in DECENT)

- Group presentation (+), communication (+), conferencing (+), and social interaction (+)

- Prototyping (+) and review (+)

- Training, education, rehearsal (+), learning

- New product or system demonstration

- Identity role-playing, team building, and other social processes

- Multi-media storytelling and avatar control/choreography

- Mirrored worlds (+) and memorialization

- Game development (+) and/or modding (+)

- Socio-technical process discovery

- Enabling human behavior transformation

Conclusions and recommendations for future studies

- DECENT demonstrates a transformative reduction in cost of rapidly creating and deploying C2 systems supporting DCC

- DECENT can be deployed via pocket storage devices (flash storage thumb drives)

- Much remains to be studied using DECENT like technologies and approaches to DCC

  - Potential of C2 mission planning games on human resource development (e.g., find people who play well with DCC)

- R&D should seek to demonstrate future benefits and articulate system/software risks for supporting decentralized collaboration affordances.

Acknowledgements