Using Large Group Displays to Support Intensive Team Activities in C2
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Outline

• LGDs and Operation Centers
• Teams and Intense Collaboration
• Benefits of Large Group Displays (LGDs)
• Examples of LGDs use and challenges
• Guidelines
  – Information Content
  – Content and Display Management
  – Integration
  – Interaction
Large Group Displays in an Operation Center

Prince Sultan Air Base Air Operating Center

Boeing Commercial Airplanes Operating Center

Lockheed Martin's Center for Innovation (Lighthouse)

Burlington Northern Operations Center

Network Line International

CA Regional Joint Operation Center
Use of LGDs

• Often used to
  – Conduct presentations
  – Show multiple new channels
  – Display a static view of the operational environment

• Not used to their full benefit

• Why?
  – Insufficient time is devoted to the broader design considerations
  – Technology often too complex to be used by most users and so only rudimentary features are used

• Unaddressed questions
  – Who are the LGDs intended for ?
  – What information should be displayed ?
  – How is the information shown controlled ?
Teams and Collaborative Working in C2

• Team
  – a distinguishable set of two or more people
  – who interact dynamically, interdependently, and adaptively
  – toward a common and valued goal/objective/mission
  – who have each been assigned specific roles or functions to perform and
  – who have a limited life-span membership

(Salas et al., 1992)
Intense Collaboration

Intense Collaboration and the Information Age

Benefits of LGDs

• Support team working, when
  – Operators require concurrent use of information
  – Operators have common information needs
  – Operators have shared tasks
  – There are non-conflicting task needs
  – Feedback is required to be given to the whole team
  – Tasks require a common frame of reference
  – High-level summary or overview of information needs to be provided

McLeod (1997)
• Information Integration
• Summary Information
• Reducing the briefing cycle
• Information Quality
Key Knowledge Wall Concepts

- Provision of shared situation awareness
- Multiple displays viewable from a distance
- Information displayed is filtered, synthesized, fused, interpreted and summarized by specialists on the command staff
- Large displays to show the tactical situation
- Small displays used as to show graphically
  - Mission summaries, planned responses, rules of engagement, current and future operational information, alerts, video conf.
- Ability to drill down in html-formatted summaries, via hyperlinks
- Possibility to switch the small displays to the large displays
- Display on the age and reliability of the information
- Use of a briefing tool
MITRE SideView

Overview of mission objectives, based on warning order from CJCS

Current state of development of mission analysis components

Task timeline view customized for knowledge wall

FBV-type COP display customized for knowledge wall

FBV drilldowns
Key MITRE SideView Concepts

• Situation awareness: Common Operational Picture display incorporating multiple overlays
  – Mission overview
  – Current status
  – Task timeline with summary information
• Large display area
• Information viewable from a distance
• Team / Task related information
• Publish/subscribe mechanism / Information manager
AFRL Interactive Data Wall

- Large seamless working area
- Multimodal interaction
Key Data Wall Concepts

- Shared situation awareness & collaborative working
- Large seamless display surface
  - 3840 x 1024 pixels across a 12' x 3' screen area
- Multimodal interaction
  - Voice, wireless pointer, mouse, electronic grease pencil
- Multiple concurrent users
- Data display elements include detailed terrain, land route maps, real-time audio/video communications, airborne surveillance and intelligence information, archived geographic database information, and modeling and simulation information
DSTO LiveSpaces

Media Translation

Natural Interaction

Coordination and Orchestration

TeamSpace Interfaces

Session & Information Management
Key LiveSpaces Concepts

• Collaborative working & shared situation awareness
• Integration and collaboration infrastructure
  – Includes displays, smart boards, room facilities (lights, speakers), cameras
• Multiuser and natural interaction
• Collocated and distributed collaboration
• Awareness of
  – Availability of particular facilities and applications
  – Faults that might impact on the team activities
NSWC Integrated Command Environment (ICE) Lab
Key ICE Lab Design Concepts

- Shared situation awareness
- Key analysis of the human engineering factors
  - Legibility
  - Required head rotation and viewing angle
  - Lack of interference from intervening objects, personnel
  - Ambient lighting
- Information on LGDs should assist multiple operators in the completion of their respective tasks
- Use of redundant displays
Content and Display Management

**Mediated**
Individual users cannot push directly to the wall; permission must be granted by an authorized “information manager”

- Information manager restricts what applications may run on the wall and/or what information they can show
- Information manager “throttles” what is shown within the merged view on the KW
- IM can activate/deactivate individual “view filters”

**Freeform**
Individual users can directly push data views onto the wall

- KW becomes a democratic collaborative whiteboard for public display of information developed by individual analysts
- Multiple instances of the same application share their views of a common or disparate data sets
- Running applications constraint what/how information may be shown

**Direct display**
User designates specific information to appear on the wall in a chosen location

**Merged Views**
Applications on the wall “fuse” the data views developed by individual users

Dugger and Barley (2000)
Conclusion - Need proper design

• Information Content
  – What should be displayed?
  – Why is it needed?
  • Shared situation awareness
    – Awareness of the operational situation
    – Awareness of the internal workings of the team
  • Collaborative working
    – When should it be provided?
    – How should the information be provided?
      • Display simplification techniques such as providing summary information, highlighting, grouping and attention management
    – What is the usability (e.g. size, format and legibility)
Conclusion

• Content and Display Management
  – Manual and automated
  – Organization of the information

• Integration
  – Integration with the C2 tasks and processes
  – Redundancy

• Interaction
  – Multi-user and multi-modal
  – Natural
  – Distributed collaboration
  – Drill down
Acknowledgement

TTCP C3I TP2
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