



# A Study of the Usability and Usage of the Data Wall at JEFX

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Presentation to the 10<sup>th</sup> ICCRTS

# Company Background

- **Formed in 1958 when first employees migrated from MIT's Lincoln Labs**
- **Not-for-profit corporation that manages three Federally Funded Research and Development Centers: DoD, FAA, IRS**
- **5,700 Employees headquartered in Bedford, MA and McLean, VA with 60+ sites worldwide**
- **Systems Engineering and R&D**
  - **Engineers (from Sensors to Systems Security)**
  - **Scientists (from Artificial Intelligence to Aeronautics)**

# Data Wall Studies

- **Refined the methodology**
  - Department of Homeland Security's Federal Emergency Management Agency Regional Operations Center (FEMA ROC) on 27 July 2004 for two hours during the Democratic National Convention
- **Main DW study**
  - Joint Expeditionary Force Experiment 2004 (JEFX '04) from August 2-3 during the main experiment (MainEx)



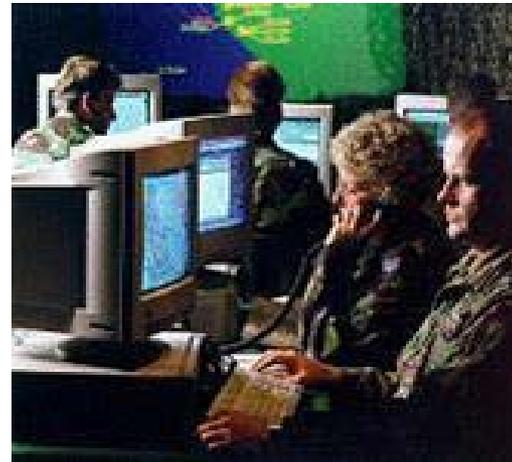
# Content of DW

a	b	e	f	g	a	b	e	f	g
c	d				c	d			

<b>a</b>	<b>PowerPoint “rotisserie”</b>	<b>e</b>	<b>Weather (static)</b>
<b>b</b>	<b>Blank desktop</b>	<b>f</b>	<b>Automated Deep Operations Coordination System</b>
<b>c</b>	<b>Blank desktop</b>	<b>g</b>	<b>Air Defense Systems Integrator</b>
<b>d</b>	<b>PowerPoint slide</b>		

# Methodology

- Imperative that we did not disrupt operations
- Four components:
  - Ergonomic evaluations
  - Heuristic evaluations
  - Observations
  - Interviews



# Ergonomic Evaluation

- **Visibility Assessment – standing in multiple locations around the room and noting what can be discerned on the DW**
- **Visual angle calculation to determine the ideal viewing distance from the DW**



$$va = \tan^{-1}(h/d) * 3438$$

# Heuristic Evaluation

- **Heuristics for evaluating large shared displays intended for high-level comprehension and self-defined interruption**
  - **Appropriate color schemes can be used for supporting information understanding**
  - **Layout should reflect the information according to its intended use**
  - **Judicious use of animation is necessary for effective design**
  - **Use text banners only when necessary**
  - **Show the presence of information, but not the details**
  - **Using cyclic displays can be useful, but care must be taken in implementation**
  - **Avoid the use of audio**
  - **Eliminate or hide configurability controls**

Somervell, J., Wahid, S., McCrickard, S. (2003). “Usability Heuristics for Large Screen Information Exhibits,” *Interact 2003 Ninth IFIP International Conference on Human-Computer Interaction*.

# Observations

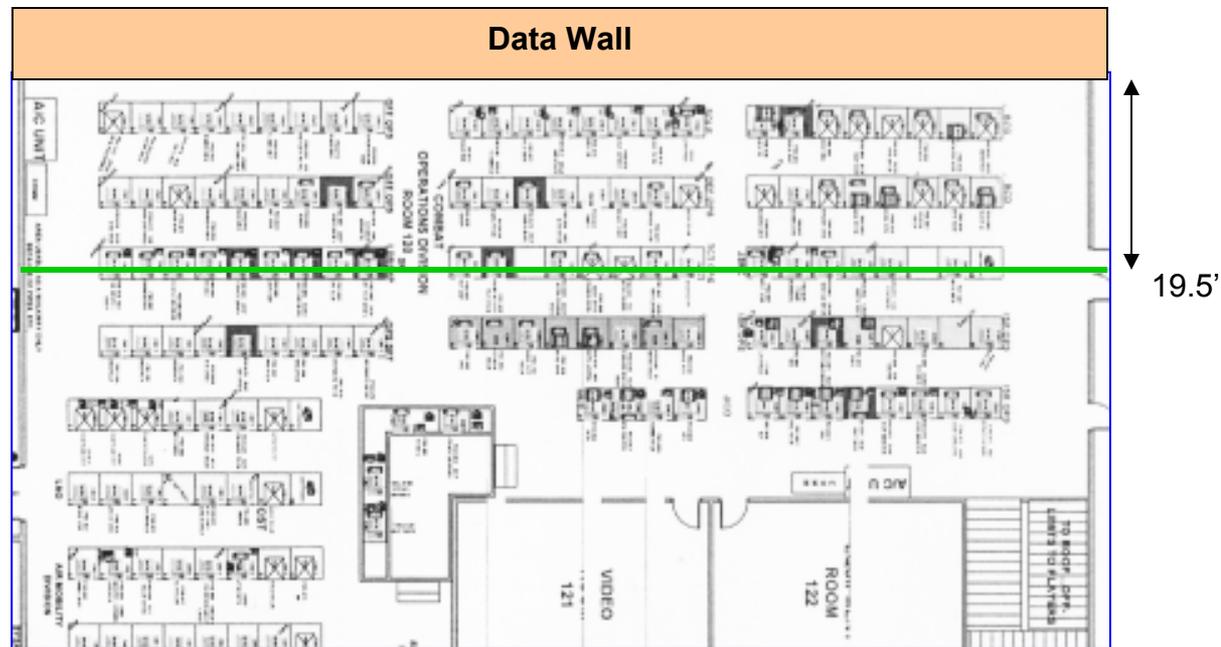
- **Interested in seeing how DW was utilized**
  - While at workstations to gain a shared awareness of the high-level status
  - Upon walking onto the operations floor to understand how activities had changed
  - When having standing discussions away from workstations and could use the DW as a common point of reference
  
- **General observations were conducted continuously over the two days**
  
- **More focused observations conducted in ten minute intervals for 90 minutes total**

# Interviews

- **Gauged when operators may be receptive to answering a few quick questions**
  
- **Initial set of questions were based on the Critical Incident Technique and asked people to recall a particular instance, such as “Describe a time that the DW assisted you in completing a task”**
  - **FEMA ROC personnel seemed unsettled by these types of questions**
  
- **For JEFX, questions tailored to be more direct**
  - **Are you able to easily read the information on the DW?**
  - **How often do you look at the DW? For what purpose?**
  - **What changes would you make to the DW?**

## Usability of JEFX DW (1 of 2)

- Ideal viewing distance calculated to be the third row
- In congruence with findings from the visibility assessment



# Usability of JEFX DW (2 of 2)

Heuristic		Rationale
Appropriate color schemes used	✓	
Proper layout followed	X	Layout not designed with location of operators on the floor in mind
Animation used judiciously	✓	
Text banners rarely used	X	Abundance of text
High-level information presented	X	Showed details on the individuals' workstations that were mirrored
Cyclic displays carefully implemented	X	Cycled through the same PowerPoint slides day after day
Audio avoided	✓	
Configuration controls removed	X	Showed configuration controls of individual workstations that were mirrored

## Usage of JEFX DW (1 of 3)

- **Consulted while at workstations to gain a shared awareness of the high-level status**
  - During an hour of observation, **10 operators** glanced at the DW
- **Looked at upon walking onto the operations floor to understand how activities had changed**
  - In 30 minutes of observation, **0 people** looked at the DW when entering the MainOps floor
- **Referred to when having standing discussions away from workstations**
  - Over the course of two days, **1 small group** of operators referred to it

## Usage of JEFX DW (2 of 3)

### ■ Sixteen operators interviewed

Why <i>never</i> looked at the DW	# of Operators
Cannot read it from my seat	3
Not appropriate for my role	5
Why <i>occasionally</i> looked at the DW ~ 1/day	# of Operators
Look at what the TCT chief is currently working	3
Compare app on wall to app on my workstation	1
When directed to by a superior	1
Why <i>often</i> looked at the DW ~ 1/hour	# of Operators
Sit directly in front of the information of interest	2
My workstation is mirrored on the DW	1

**CCO: “The information isn’t at the right level for me. It’s for the CFACC”**

**CFACC: “The information is for the CCO, not for me.”**

## Usage of JEFX DW (3 of 3)

- **Consequences of having individual workstations mirrored onto the DW:**
  - Screensaver turned on **15 times** from inactivity and the operators had to type in their passwords to unlock
  - Operators pulled pop-up windows off of the screens being mirrored **96 times** for privacy
  - TCT Chief positioned part of his applications below the screen so as not to misdirect his team

# Summary

- **Few operators consulted the DW between Aug 2-3 of MainEx**
  
- **Recommendations**
  - **Do not mirror operators' workstations onto the DW**
  - **Present information graphically with little text to encourage the presentation of high-level information**
  - **Develop presets that can be easily switched on or off depending upon the current situation, such as downed aircraft**
  - **Continue to not display Predator video, or other information that would attract attention unnecessarily**
  - **Provide smaller, collaborative displays for teams and groups**

# Don't Miss These Talks

## ■ Better Together

### – JEFX DW + Shared User Interfaces

- Sandeep Mulgund's talk: today, 4:15-4:45 (this room)

## ■ Whether or not you enjoyed this talk, we think you will enjoy

### – Analyzing Decisions and Characterizing Information in C2 Systems

- Don Means's talk: June 15, 2:30-3:00 (room 1)