



SPAWAR
Systems Center
San Diego

Global 2000 - Prototype Knowledge Wall

(installed at Naval War College & aboard USS Coronado)



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Why a “Knowledge Wall”?

- ◆ Suggested by requirements identified through “Knowledge Engineering” with C3F & C2F command staff over past 3 years.
- ◆ Intended to *facilitate* knowledge for key JOC personnel through use of decision support & collaboration technology. Relies on “knowledge management” processes for content.
- ◆ Product of number of years of research
 - Decision-making & Effects of Stress
 - Decision Support Technology (e.g. TADMUS)
- ◆ Under accelerated development for Global 00 at request of C3F & CCG-1, with ONR sponsorship.

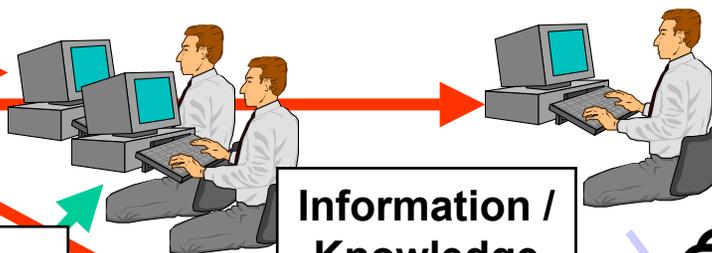
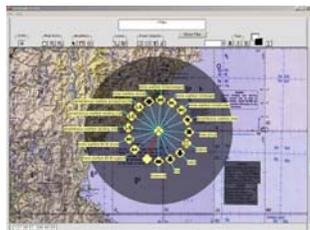
What the Knowledge Wall is ...

- ◆ **A prototype (ver. 1.0) & research tool using beta software and untested concepts designed for CJTF.**
 - Really a *data wall* with a number of windows dedicated to high level summaries of key functional areas of the command,
 - Uses a “*Knowledge Web*” as a means of capturing value added information from sub-ordinate commanders, and distributing that information as widely and quickly as possible, across and between command echelons.
 - Relies on Template authoring tools to structure content consistently across the Knowledge Web, yet allow tailoring of content to meet diverse information needs. Allows the *distributed* and *asynchronous* production and consumption of information.
- ◆ **An attempt to explore how emerging technology *should* be used to take advantage of network-centric warfare to enable knowledge-centric warfare and increase *Speed of Command*.**



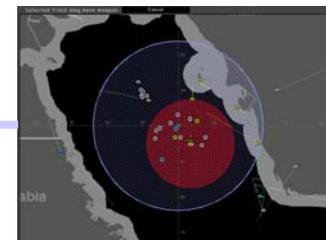
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Knowledge Web Concept



Information /
Knowledge
Producers

Tactical Picture(s)

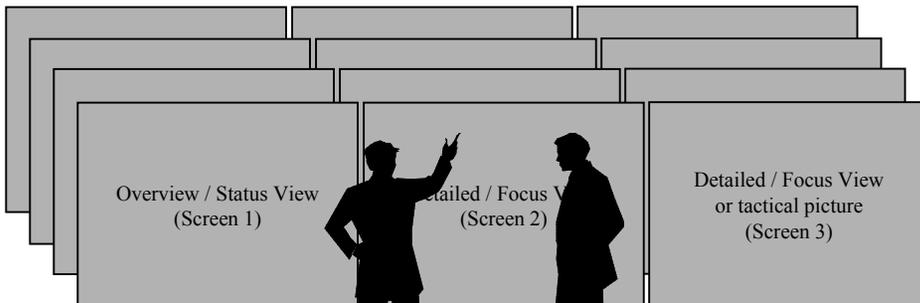


**Tailored GOTS / COTS
Information Production Tools
Address information needs**

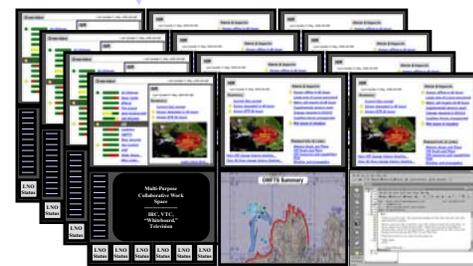
Various
Server(s)



Other Info



**Knowledge Walker(s) – Group
Consumers**



**Knowledge Desks – Individual
Production / Single Consumers**

What the Global KW is *not* ...

- ◆ **A mature product!**
- ◆ **KW does not inherently contain Knowledge”!!**
 - **“Knowledge” facilitated by experts / staff authoring the information products (traditionally in watch turn-over briefs) presented on the wall.**
 - **KW facilitates knowledge *recognition* and *use*.**

What is decision support?

Decision Support can be defined as:

- ◆ **Identifying the data required to make a decision, gathering it together organized as meaningful information to accomplish an information processing task. (*TADMUS*)**
 - presenting information where it is needed,
 - when it is needed,
 - the way it is needed.
- ◆ **Decision support is philosophically different from decision aiding and adaptive automation**
 - By design – Decision support does not take decision-making away from decision-makers.
 - Decision support does attempt to “pre-digest” data and information – get it in a form where it can be readily processed to accomplish a critical task.
“Get the decision-maker in the ball park.”

Naturalistic Decision Making

- ◆ **Experienced decision makers use non-analytic strategies**
 - Recognition-Primed strategy (Klein et al.)
 - Explanation-Based Reasoning (Pennington & Hastie)
- ◆ **Experience leads to use of heuristics as shortcuts.**
 - Heuristics are double-edged swords, e.g:
 - Framing Bias
 - Anchoring Bias
 - Confirmation Bias
- ◆ **Stress Affects Performance.**
 - Hypervigilance (Impulsive action)
 - Intolerance of ambiguity
 - Fixation on primary task & tunnel vision
 - Less communicative
 - Short-term memory degradation

Other Definitions ...

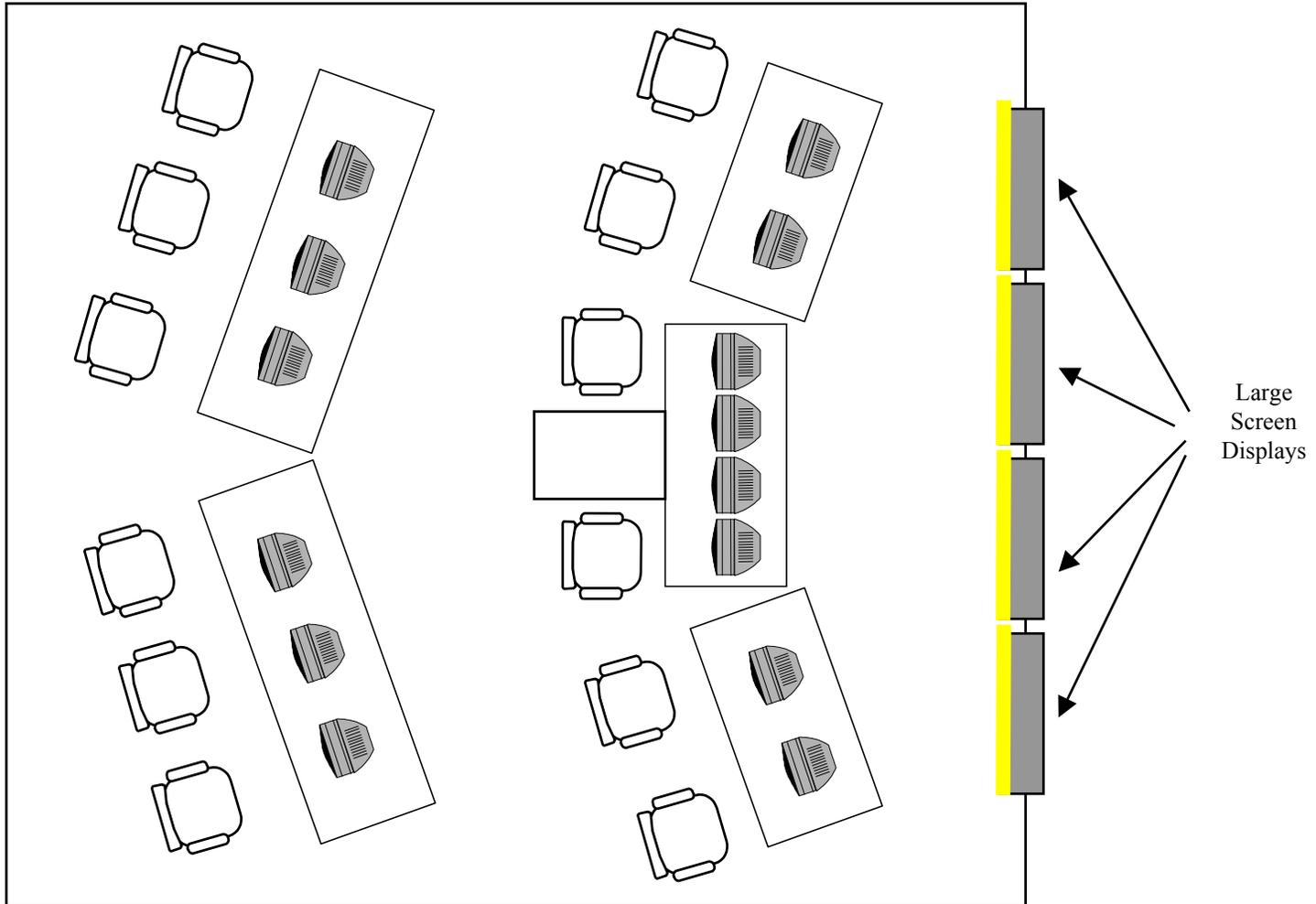
- ◆ **Decision Support System (DSS)** – a computer application that integrates data around decision-making problems addressed by a decision maker using cognitive science / HF design principles.
- ◆ **Data Wall** – Hardware that creates a large, wall size, computer driven graphic display with high resolution that operates as an integrated desktop.
- ◆ **Knowledge Wall (KW)** – A concept for *the application of decision support tools to a data wall* that supports group decision making & collaboration.
- ◆ **JOC Of The Future** – An integrated *concept of operations* incorporating decision support systems, advanced workstations, and processes for their use consistent with knowledge management.



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USS Coronado JOC: 1997-2000

(Representative Decision Making Workspace)



Cognitive Tasks Analysis Results: *Process Problems Identified*

- ◆ **BWC needs assistance integrating data and defining and displaying information to the CJTF and the battle watch when dealing with operational issues**
 - Need integrated, coherent information organized around specific problems – Intuitive “Summary” graphics.
 - Anchor Desks need ability to effectively monitor both tactical / operational displays – “Portholes into an ocean of data.”
- ◆ **“Collaboration” is problematic**
 - COTS collaboration tools not adequate, collaboration is “asynchronous” vice “brain storming”
 - Difficulty reaching across functional areas & across echelon
 - Different update rates for different functional areas
 - Only time everyone “knows” what is known is at Flag briefings.
 - Hard to know what information is “value added” to seniors & peers
- ◆ **JOC requires an effective communications capability between watch-stations**



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Cognitive Tasks Analysis Results: *Content* Requirements Identified

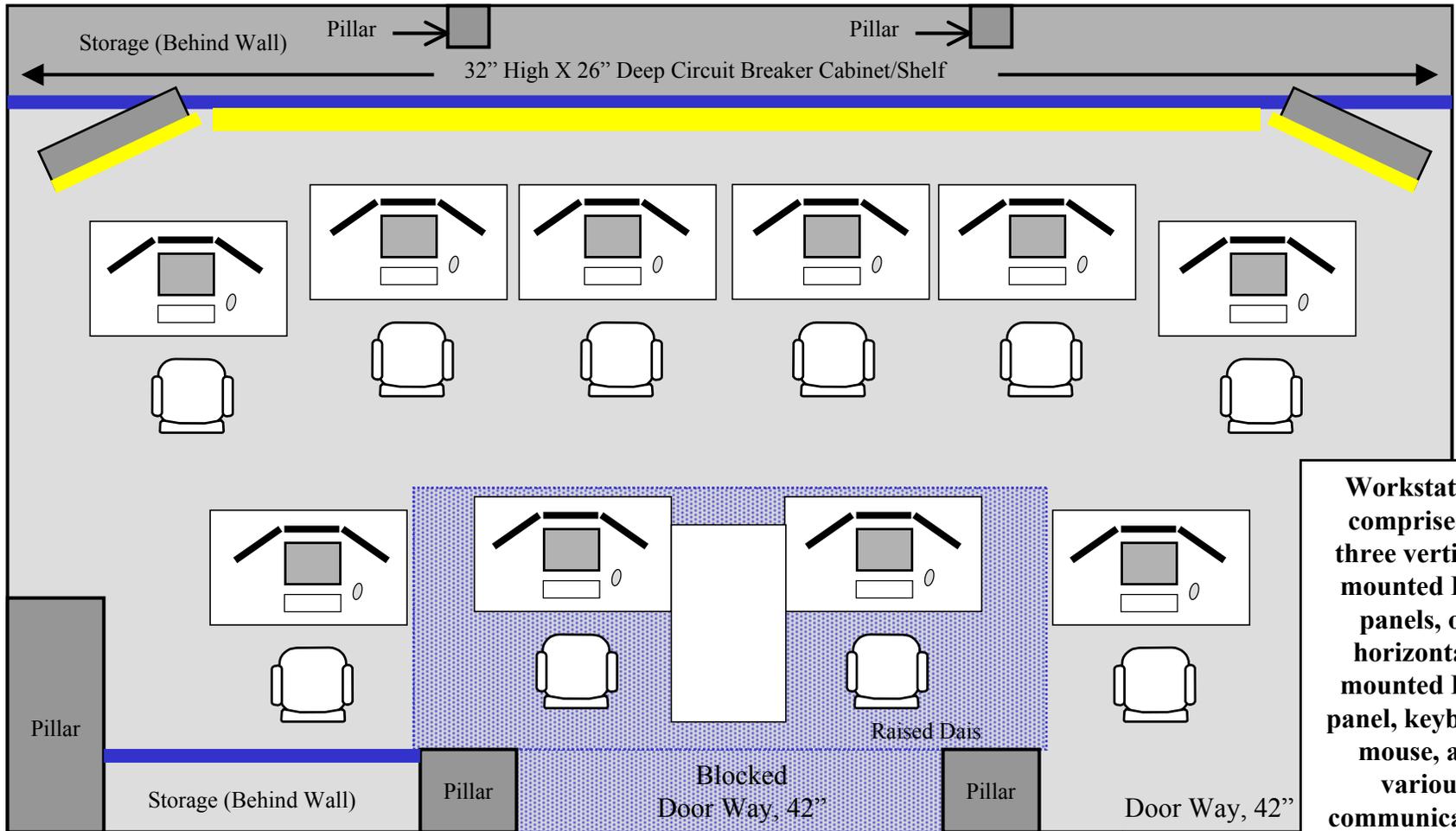


- ◆ **Tactical data (multiple views if possible!)**
 - Map-based and highly graphical views / context
- ◆ **Mission Summaries and Commander's Intent**
- ◆ **Real-time info! (*or close to it*)**
- ◆ **Alerts / Advisories / Recommendations**
 - What isn't working according to plan?
 - What do we do to fix it?
- ◆ **Impacts & Indications**
 - “X” happened; how does it affect everything else?
- ◆ **Plans (and alternate COAs)**
 - Response & Timeline Management
- ◆ **Effects Summaries**
 - Various formats preferred
- ◆ **Asset / Resource Management**
- ◆ **Collaboration Tools (*including VTC*)**



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The "JOC Of the Future" Concept... Proposed Layout



Workstations
comprised of
three vertically
mounted LCD
panels, one
horizontally
mounted LCD
panel, keyboard,
mouse, and
various
communications
devices

SSC-SD Bldg A-33, Rm 0043
Gross Dimension = 35' X 20'
(Scale: 1" = 4')



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CJTF “Knowledge Desk” Conceptual Design

Common design features across numerous function- and task-customized workstations
(e.g., BWC, Anchor Desks, CJTF, etc.)

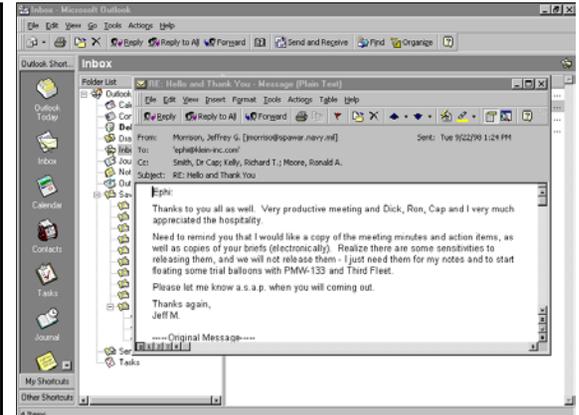


Multi-Purpose Collaborative Work Space

**IRC, VTC,
“Whiteboard,”
Television**

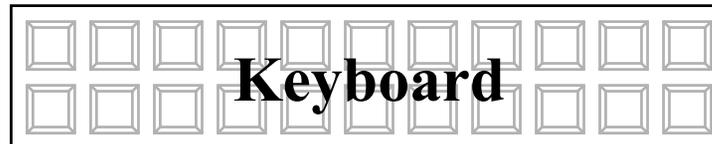
LNO Status LNO Status LNO Status LNO Status LNO Status LNO Status

**Geo-Plot / ADSI / JMCIS
/ MCCIS Picture**



Communications
Access Panel
(Secure and
Un-Secure Radio R/T
Circuits)

(Lower display
inset horizontally
into work
surface)



Left-most and
right-most
displays angled
20° - 30° toward
user

STU-III
Phone

POTS
Phone





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CJTF “Knowledge Desk” - Conceptual Design

Common design features across workstations (e.g., BWC, Anchor Desks, CJTF, etc.). Numerous function- and task-customized decision support tools



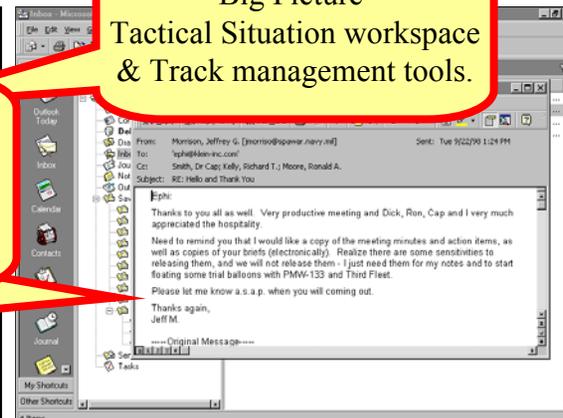
Multi-Purpose Collaborative Work Space

IRC, VTC, “Whiteboard,” Television

LNO Status LNO Status LNO Status LNO Status LNO Status LNO Status

Information from this anchor desk is “Pushed” to the Knowledge Wall and anyone who chooses to “subscribe” to it. It is shown in different “views” depending on user needs.

“Big Picture” Tactical Situation workspace & Track management tools.



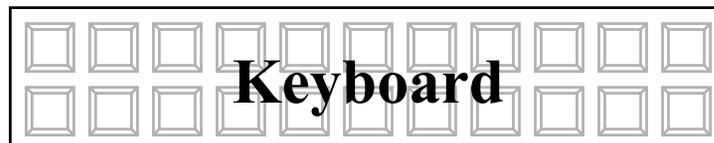
Communications Access Panel (Secure and Un-Secure Radio R/T Circuits)

Tools to “Work the Seams” (e.g. JFlex) and manage the battle-bridge planning & real-time.

displays angled 20° - 30° toward user

POTS

(Lower display inset horizontally into work surface)





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Conceptual CJTF Collaborative Decision Support System:

A "Picture Window" into a "sea of information"

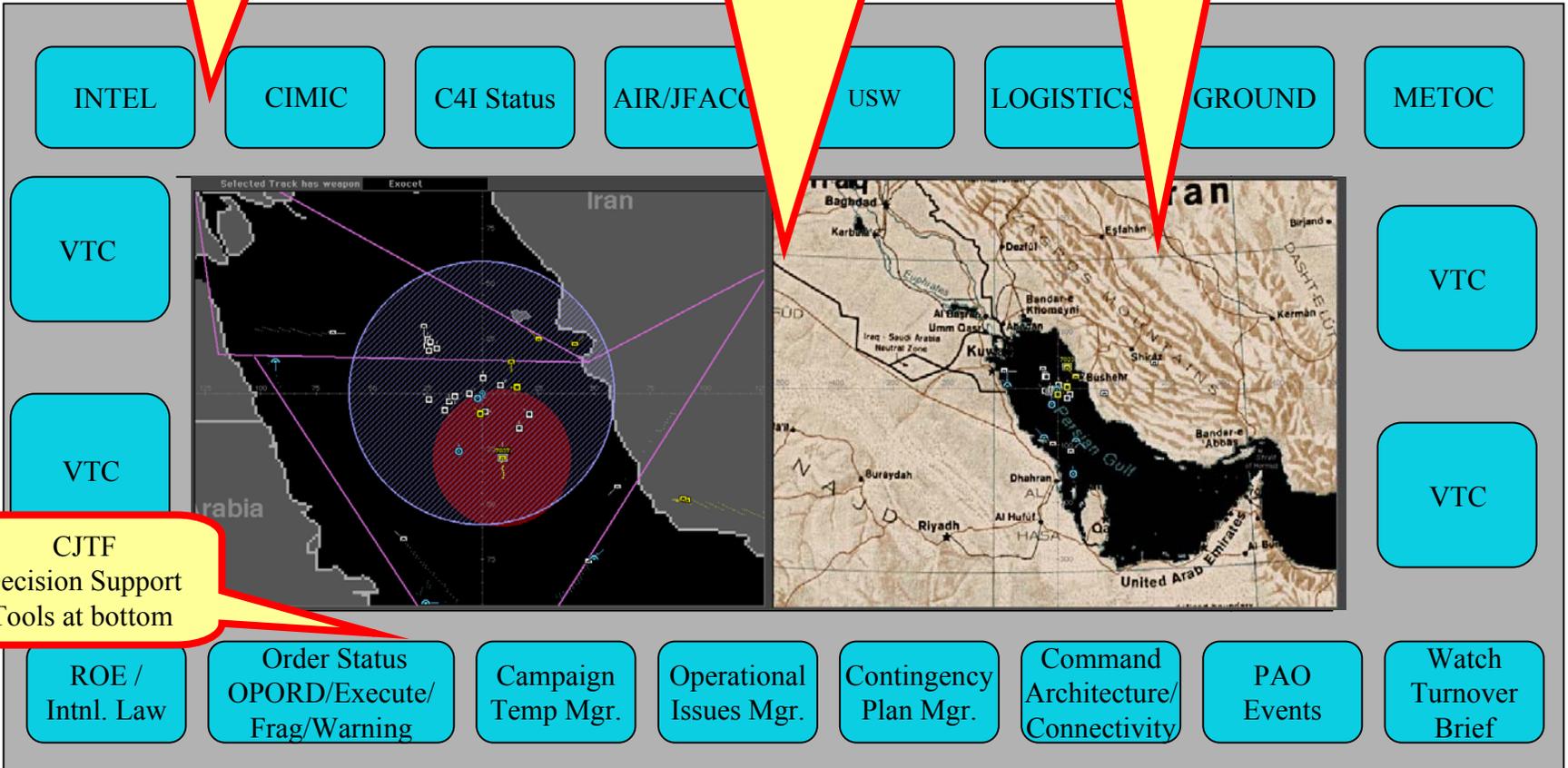
displayed using a 4096x2304 "data wall" & fed from Anchor Desk DSS's.



CJTF Anchor / LNO
Desks Summary Displays
across top.

BWC would swap perimeter displays in and out of
large collaborative displays through voice and/or
gesture commands

Large workspaces for
collaborative decision making -
amplify on summary displays
in perimeter





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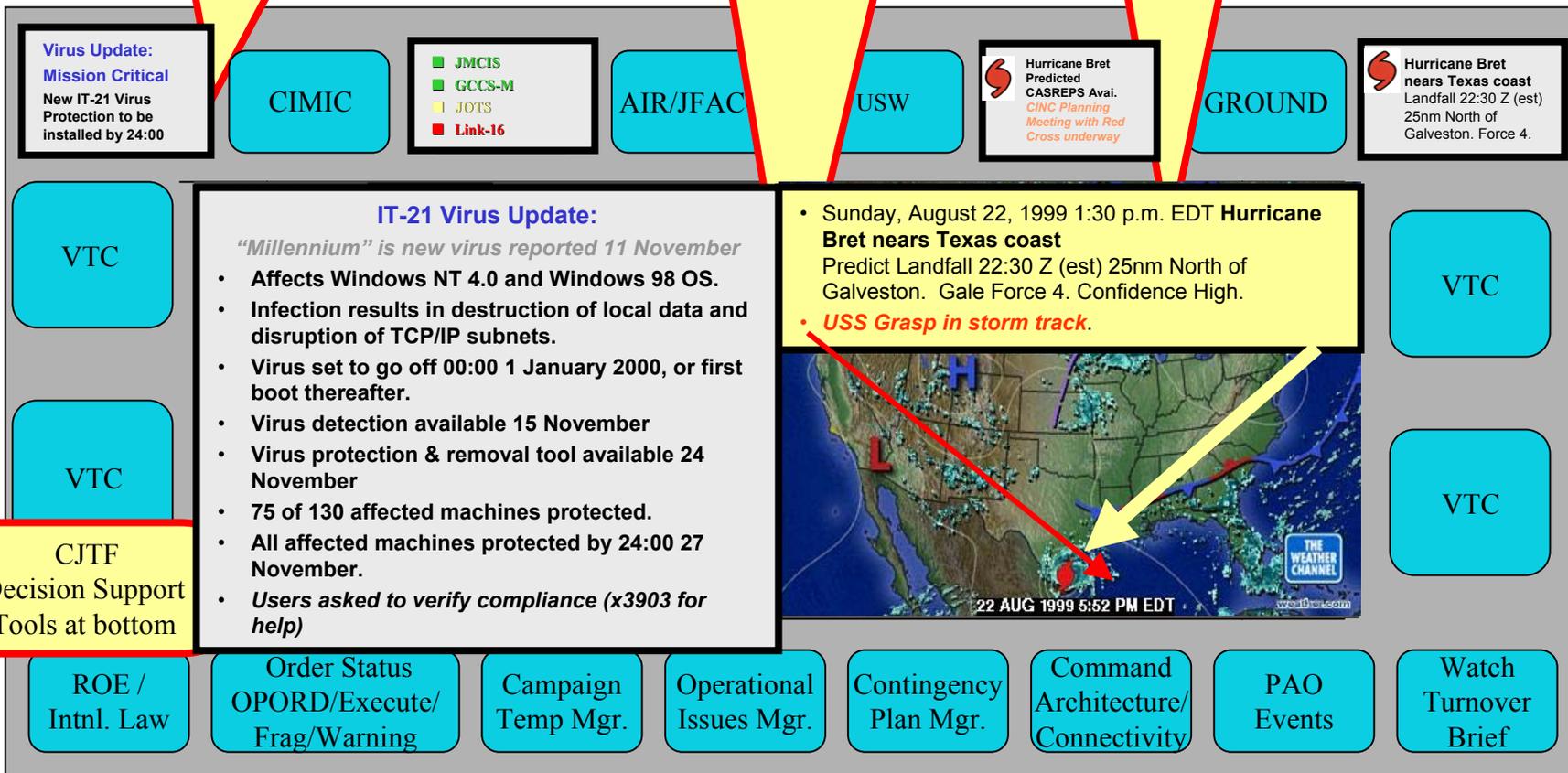
Conceptual CJTF Collaborative "Knowledge Wall": A "Picture Window" into a "sea of information" displayed using a 4096x2304 "data wall" & fed from Anchor Desk DSS's.



Abstracted summary Displays from CJTF LNO / Anchor Desks across top.

BWC would swap perimeter displays in and out of large collaborative displays through voice and/or gesture commands

Large workspaces for collaborative decision making - amplify on summary displays in perimeter





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*Conceptual CJTF Collaborative “Knowledge Wall”:
A “Picture Window” into a “sea of information”
displayed using a “data wall” & fed from Anchor Desk DSS’s.*



The Command 21 “Knowledge Wall” vision:

The dashboard is organized into several sections:

- Summary Panels:** Satellite Imagery, Intell Summary (Intel), C4I Status (C4I), JFACC Summary (JFACC), Undersea Summary (Undersea), Ground Summary (Ground), and METOC Summary.
- Video Feeds:** Three small video windows on the left side showing different scenes.
- Map Panels:** Two large maps in the center. The left map shows a region with a red circle and a blue circle, labeled 'Selected Track may have weapon' and 'Esocet'. The right map shows a network of pink lines connecting various points, labeled 'Selected Track may have weapon' and 'C-801'.
- Operational Panels:** A row of ten small panels at the bottom, each displaying a track ID and details:

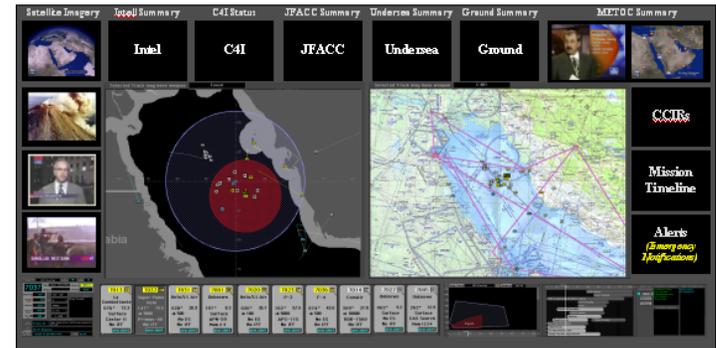
7037	7013	7037	7031	7001	7020	7023	7036	7014	7027	7005
La Combattante	Super Puma Helo	Helo/Lt Air	Unknown	Helo/Lt Air	P-3	F-4	ComAir	Unknown	Unknown	Unknown
076° 13.3	147° 15.5	026° 28.9	197° 8.3	026° 35.7	102° 57.5	074° 43.6	309° 27.8	062° 9.2	262° 12.9	262° 12.9
Surface	→ 3000	→ 500	Surface	→ 100	→ 5000	→ 500	→ 10000	Surface	Surface	Surface
Caster II	Primus-40	No ES	APN-59	No ES	APS-115	No ES	RDR-1500	No ES	CAS Search	Made 1234
No IFF	No IFF	No IFF	Node 2 S	No IFF	No IFF	No IFF	No IFF	No IFF	No IFF	No IFF
- Right Side Panels:** CCIRs, Mission Timeline, and Alerts (Emergency Notifications).

“Web-Enabled, Knowledge-Centric Warfare”

Limiting Factor: Current Technology

◆ End Vision

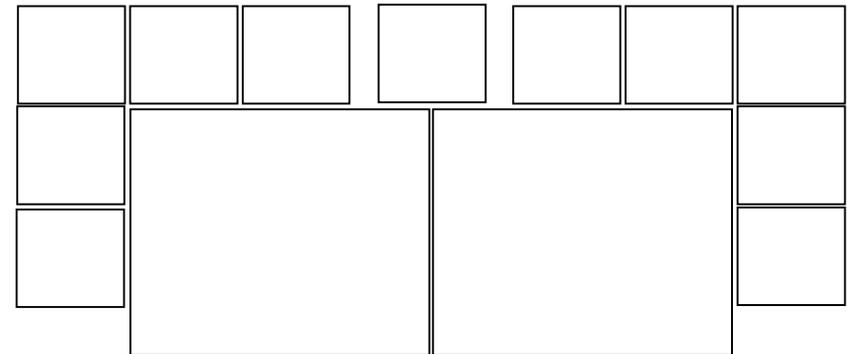
- **Video-display cubes creating seamless, wall-sized, fully configurable display**
 - Virtually unlimited number and sizes of windows in single “desktop”.
 - Dedicated Decision Support tools.



← ~ 20' X 10' ? →

◆ State-of-the-art

- **Multiple displays using different technologies arranged in a grid.**
 - Number and size of windows limited due to hardware cost
 - Heavily reliant on “browser” technologies.
 - Resolution of windows limited due to software status
 - Single integrated “Desktop”.



Global 00 Implementation

◆ Summary

- **Develop “Knowledge Wall” as a web-enabled, dynamic status board onto which different decision-makers “post” information using pre-designed web pages.**
 - Focus on JOC / CJTF core staff requirements.
- **Implemented with browser windows pointed at HTML summary pages. Pages to have consistent format, but content modifiable as needed by anchor desk LNOs.**
 - *Knowledge Wall* - shell application to load content & manage browser windows.
 - *TacGraph* - application to rapidly create map-based graphics & publish as HTML & JPG with MILSPEC 2525 symbology, NIMA maps & drawing tools as well as ability to link to other content.
 - *SumMaker* - application to rapidly build templates, link to a variety of content sources & publish as HTML.
- **Players (and/or support staff) must manually update their data on regular basis.**



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Final Global 00 Functional Organization



<i>Functional Area (CJTF)</i>	<i>Responsible Agent</i>
Ground Control /CAS	ARFOR MARFOR
OMFTS	MARFOR
TMD	NAVFOR ARFOR
Air Defense	AFFOR
Deep Strike / Interdiction	AFFOR
Sea Control	NAVFOR
SOF	JSOTF
Rear Area Security	(Brown)
ISR	J2
Fires Coordination	J31
Effects	J35
Information Warfare	J39
Logistics	J4



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Notional Layout



VTC or News broadcast
(not part of KW, exact size TBD)



The dashboard layout consists of 14 panels arranged in two rows. The top row features:

- Overview:** Lists categories like NAVFOR, MARFOR, AFFOR, ARFOR, Coalition 1, Coalition 2, Coalition 3, Space, Air, Land, Sea, TAMD, Fire Coord, and Strike.
- Overview 2:** Lists categories like Intel, Current Ops, Future Ops, Logistics, Comms & IS, KM, JSOTF, and METOC.
- Domain / Title:** Lists categories like Current, Next 24 hrs, and 48+ hrs.
- Central Window:** A video feed of a man in a suit, labeled 'VTC' and 'WASHINGTON'.
- Land:** Lists categories like Today, Tomorrow, and Long Range.
- Domain / Title:** Lists categories like Current, Next 24 hrs, and 48+ hrs.
- METOC:** Lists categories like Today, Tomorrow, and Long Range.

The bottom row features:

- Domain / Title:** Lists categories like Current, Next 24 hrs, and 48+ hrs.
- Map 1:** A large map window showing a regional view of the Pacific Ocean and Asia.
- Map 2:** A large map window showing a global view of the world.
- Domain / Title:** Lists categories like Current, Next 24 hrs, and 48+ hrs.

145.4 inches (~12 feet) across

Basic Summary Display Layout

- ◆ Simple, consistent design for most KW summary pages
- ◆ Most of display is readable at ~15 feet
- ◆ Supports graphics, text, multimedia
- ◆ Features
 - Title / Summary
 - Color-coded indicators
 - Alerts & Advisories
 - Impacts & Implications
 - Related Links

Domain / Title	<i>Last Update (date / time)</i>
 <u>Current</u>  <u>Next 24 hrs</u>  <u>48+ hrs</u>	<div style="background-color: #d3d3d3; padding: 5px;">Alerts</div> <p><u>HTML Link to WIGS page</u> <u>HTML Link to WIGS page</u></p> <div style="background-color: #d3d3d3; padding: 5px;">Impacts</div> <p><u>HTML Link to WIGS page</u> <u>HTML Link to WIGS page</u> <u>HTML Link to WIGS page</u></p> <div style="background-color: #d3d3d3; padding: 5px;">Links</div> <p><u>HTML Link to WIGS page</u> <u>HTML Link to WIGS page</u></p>
<h2>Graphic / Media</h2>	

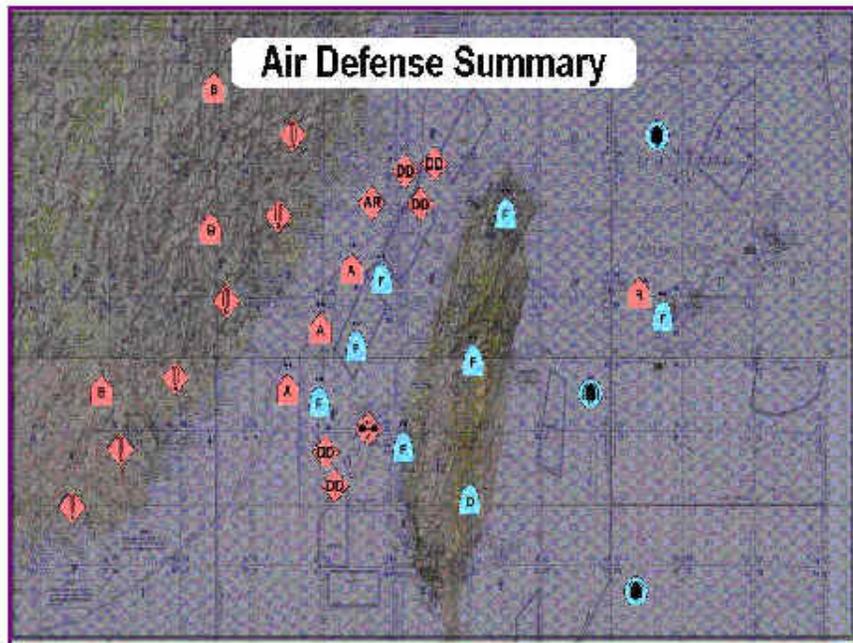
- ◆ Can be accessed directly from summary display or shifted to one of the focus windows

Air Defense

 [Today](#)

 [Tomorrow](#)

 [Long Range](#)



Last Update 08/16/00 05:55 a

Alerts

[US Forces at risk](#)

[Fuel supply limited](#)

[Storm approaching](#)

Impacts

[Air ops degraded](#)

[Enemy may withdraw](#)

Links

[ROE](#)

[Mission Summary](#)

[ATO](#)

Land

Last Update 31 May, 2000 09:42Z

 *Today*

 *Tomorrow*

 *Long Range*



Alerts

Unscheduled troop movement

Impacts

Plan timeline now inaccurate

Own force units not in position

Coalition East flank vulnerable

Links

www.intel.mil

www.coalition.au

METOC

Last Update 31 May, 2000 09:42Z

 [Today](#)

 [Tomorrow](#)

 [Long Range](#)

Alerts

[Tropical storm approaching](#)

[High surf advisory](#)

Impacts

[Small craft are endangered](#)

[Air Ops may be affected](#)

[Photo sat coverage impaired](#)

Links

www.metoc.com

www.weather.com



Overview1

Last Update 08/16/00 06:20 a

-  [Gnd Ctrl-CAS](#)
-  [OMFTS](#)
-  [Sea Control](#)
-  [TMD](#)
-  [Air Defense](#)
-  [Deep Strike](#)
-  [SOF](#)

-  [Rear Security](#)
-  [ISR](#)
-  [Fire Coord](#)
-  [Effects](#)
-  [Info Warfare](#)
-  [Logistics](#)



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SumMaker:

Summary Pages Template Tool



TempMaker

Select Template

Create Overview

Title

Last Update 07/13/00 10:47 a

R O G O Y

Today

noinfo.htm

R O G O Y

Tomorrow

noinfo.htm

R O G O Y

Long Range

noinfo.htm

Alerts

- Alert Text noinfo.htm
- Alert Text noinfo.htm
- Alert Text noinfo.htm

Impacts

- Impacts Text noinfo.htm
- Impacts Text noinfo.htm
- Impacts Text noinfo.htm

Picture [./test.jpg]
noinfo.htm

Links

- Links Text noinfo.htm
- Links Text noinfo.htm
- Links Text noinfo.htm

Create Webpage



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SumMaker: Overview Pages Template



Select Template

Create

Create Templates

Title

Last Update 07/13/00 10:49 a



Gnd Ctrl-CAS

noinfo.htm



Rear Security

noinfo.htm



OMFTS

noinfo.htm



ISR

noinfo.htm



Sea Control

noinfo.htm



Fire Coord

noinfo.htm



TMD

noinfo.htm



Effects

noinfo.htm



Air Defense

noinfo.htm



Info Warfare

noinfo.htm



Deep Strike

noinfo.htm



Logistics

noinfo.htm



SOF

noinfo.htm

Create Webpage



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TacGraph Tool

A tool for rapidly creating and disseminating tactical, non-realtime graphics



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& Engineering

Pacific Science & Engineering Group

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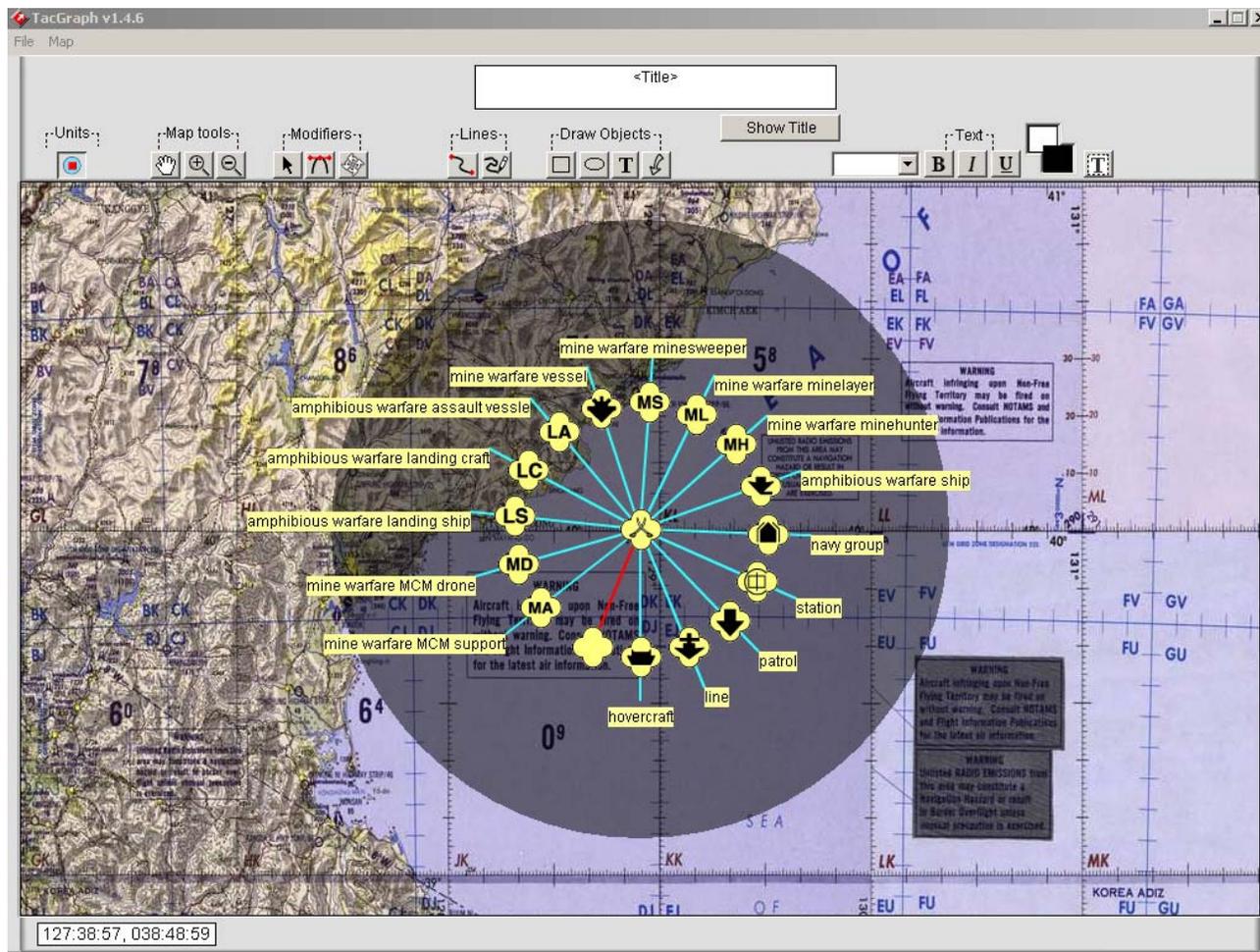
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TacGraph Menu

With MilSpec 2525b Symbol Set



- ◆ Spoke-style menu system provides access to *all* MilSpec 2525b track and unit symbols.





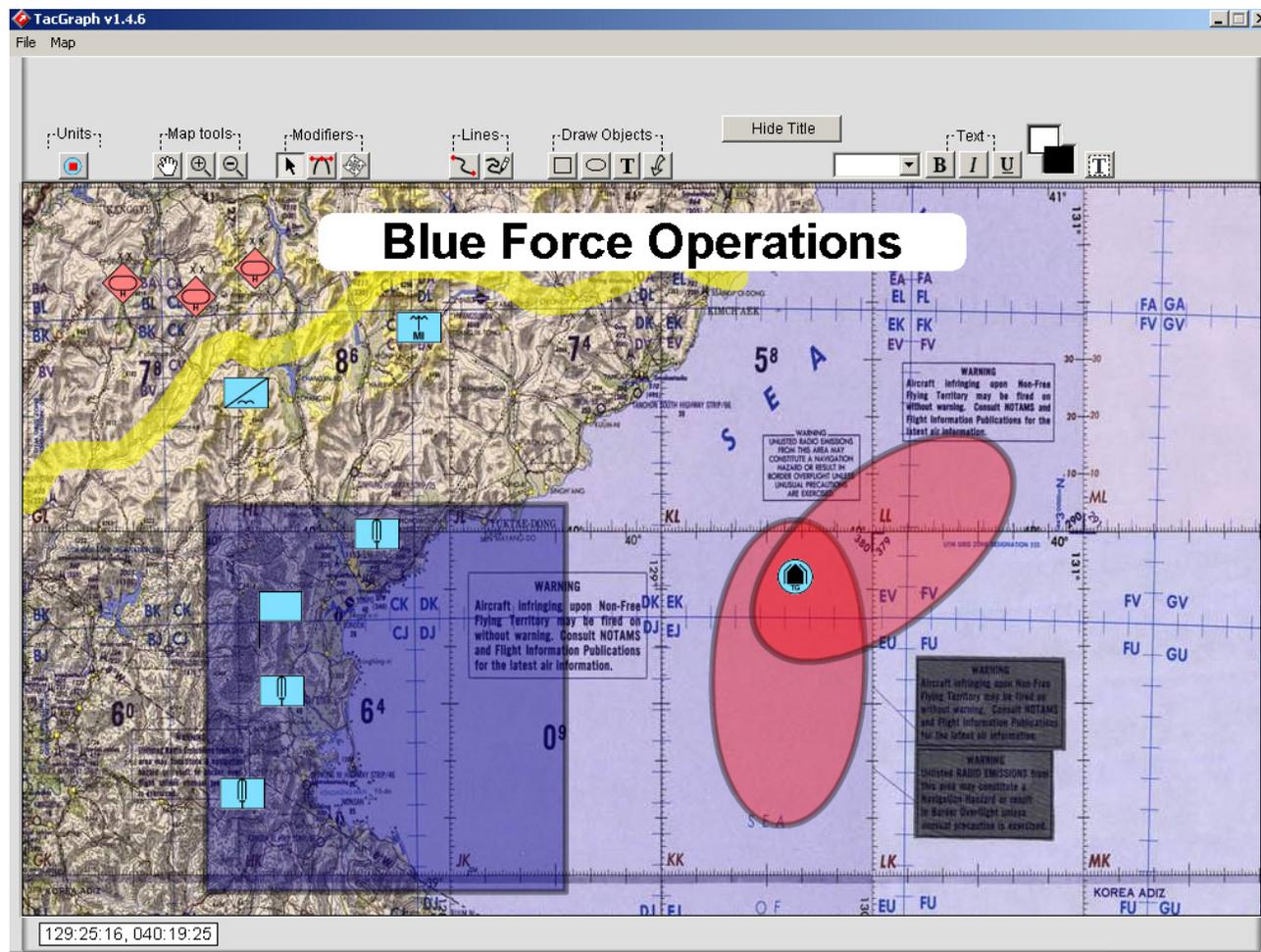
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TacGraph Display

(Embedded information and hyperlinks)



- ◆ Files created by TacGraph tool:
 - .tac is saved file retaining all individual components; can be edited
 - .jpg is “flat” graphic that can be used / imported into other applications but is not “drillable”
 - .html is “published” file that retains drill-down capability





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Global 2000 Knowledge Wall

*Preliminary Observations and
Lessons Learned, and
Emerging Results From Data Analysis*



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The power of the wall

◆ Representative comments:

- **“Speed of Command was increased by the improved SA of the CJTF. The KW was a key factor in terms of improved Speed of Command.” (RADM Zelibor, CCG-3)**
- **With regard to turning data and information into *knowledge*: “When I walked around during game play, this (the KW) was the only place it was happening.” (RADM Slaght, SPAWAR)**
- **“With less than a week of use, the KW users were able to efficiently and effectively use the wall to fight the battle. This was not so with some of the other tools available.” (Capt Fitzpatrick, CCG-3)**
- **“The graphical summaries and bulletized links presented on the wall were better than a thousand words...” (when they were done right...) (Capt Fitzpatrick, CCG-3)**
- **“The wall was a great info dissemination device... A nexus for situation-relevant information...” (RADM Zelibor, CCG-3)**

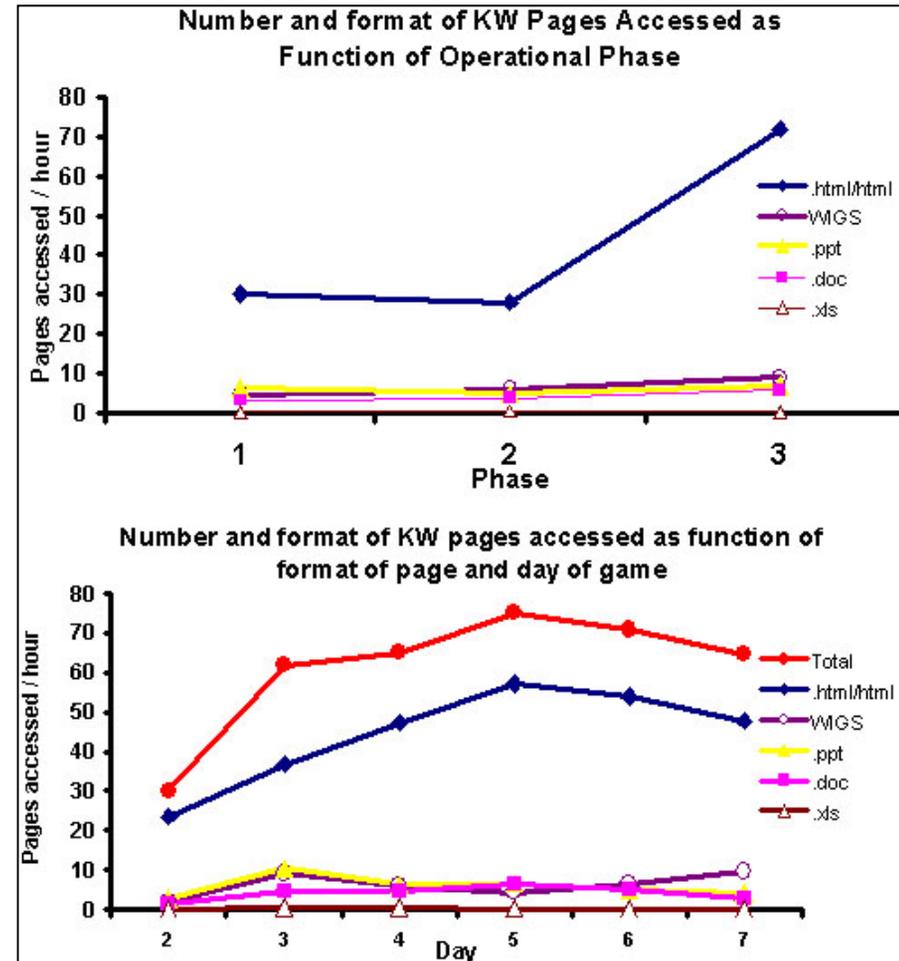
Content is key!!

◆ Representative comments:

- “**Content** (and the people who create / provide it) makes the wall useful – without the right content, it (the KW) is nothing more than a bunch of monitors.”
- “Capt Fitzpatrick (BWC / KM), through his operational and tactical experience and his familiarity with the wall, brought up the *right information* at the *right time*. Without him, I wouldn’t have found the wall useful at all.”
- “Content is key, but with the potential for many users comes the need for tailoring the content to meet the needs of the users. Different users need different information – there is no single “right” answer (with regard to content and format).”
- “Information *must* be processed and fused for presentation on the wall. When this happened, the wall was very useful.”

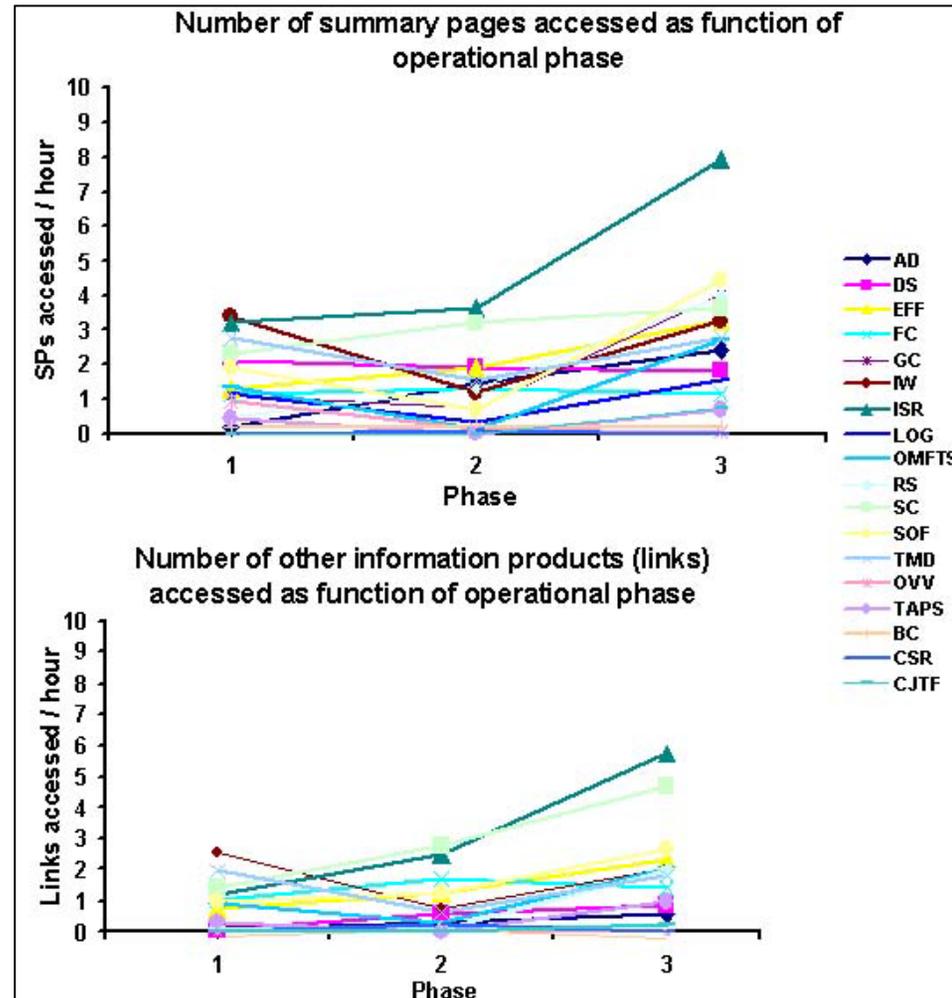
HTML Approach Seems to Work

- ◆ HTML-based data was the most often accessed form of data
- ◆ Other data forms were easily available – though not the default view
- ◆ .doc and .xls views were least used
 - A number of factors probably contributed to this fact
 - Text size
 - Overwhelming quantity of information



Functional Area Use

- ◆ Clearly, certain Functional Area Summary Pages were found more useful during certain phases of operation
 - Implies that “pushing” certain kinds of data at specific points in time might be appropriate (*e.g., when number of screens is fewer than available information sources*).



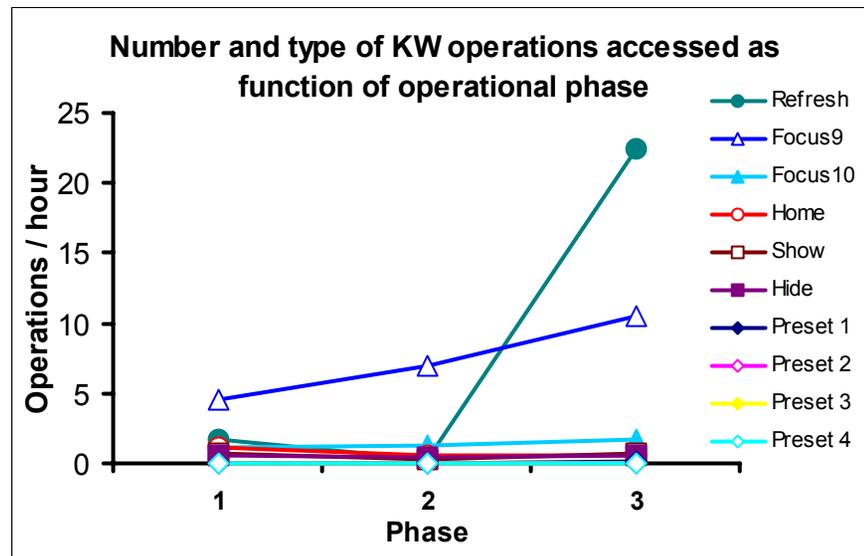


KW Use Varies By Operational Phase

◆ KW use during Phases II and III was significantly different than during Phase I

- Moving Summary Pages to focus windows for viewing
- Manual refresh of pages
 - Need for most-recent information?
 - Implies that refresh rates may need to be adaptive...

◆ Presets rarely used...



Some “gotchas”

◆ Representative comments:

- “From a CJTF perspective, the KW often allowed rapid and easy access to information in a format that met his needs.”
Counterpoint: “The CINC, NCA, and some of the Functional Area Commanders did not like the wall – probably because its content and format did not meet their needs...”
- “Timeliness, validity, and source of the presented information is vitally important – yet there is currently no way to determine these things using the wall.”
- “KW Concept of Operations – because it de-personalizes the interaction between the CJTF and his staff – allows the information provider to push what he *has* vice what the CJTF *needs.*” - *Highlights importance of evolutionary processes.*
- “There isn’t enough room on the Summary Page for me to present what is necessary...” – *Need to re-design & optimize.*

Connectivity with Remote Users

- ◆ **Entire KW concept breaks down if information producers and/or information users become disconnected**
 - The fact that most producers and users were collocated during the game made KW use possible.
 - Full connectivity necessary to allow information to be shared / linked between non-collocated sites.
- ◆ **Bandwidth characteristics dictate type and sophistication of information products shared**
 - Pages often “dumbed down” to alleviate network congestion
- ◆ **Bandwidth limitations dictate refresh rate of Summary Pages (see next page)**

Information Update / Refresh Rate

◆ **KW manual updates:**

- **KW updated as Functional Area Anchor Desks felt necessary – sometimes often, sometimes infrequently**
 - Method (perhaps automated) needed to ensure pages are updated regularly
 - KW users often stated strong desire for up-to-date, near-real-time information
- **No method (other than date / time change) to indicate updated page**
- **Internet Explorer link history issues**
 - Does not reflect when link updated unless link name changes
 - Does not always accurately reflect that page has been visited

◆ **KW automatic refresh rate:**

- **Game began with Summary Pages using automatic 1 minute refresh rate**
 - Received intermittent complaints that KW did not refresh quickly enough
- **On third day of game play, automatic refresh changed to 5 minute rate in attempt to alleviate network connectivity problems**
 - Complaints increased significantly regarding refresh rate



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Global 00 - Lessons Learned: Major KW Technology Issues Identified



- ◆ **Underlying architecture / infrastructure design**
 - Integration with other IT systems
 - Information hosting issues
 - File format and size issues
 - Archival issues
- ◆ **Connectivity with remote users**
- ◆ **Information Update / Refresh rate**
- ◆ **KW Hardware Resources**
- ◆ **Other**
 - Support applications (Summary Maker and TacGraph)
 - Component Reliability (reliance on projectors)
 - KW Mounting Rack Stability (safety issue)



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Global 00 - Lessons Learned: Underlying Architecture / Infrastructure



- ◆ **Poor integration with other IT systems hampers utility**
 - **Manual vs. automatic data updates AND explicit vs. implicit / transparent content synchronization.**
 - WIGS, C2PC, databases, models, simulations, etc.
 - Permissions / robust data management
- ◆ **Information hosting issues**
 - **Shared vs. “served” data**
 - **Location of files (single site vs. mirrored server sites)**
- ◆ **File format: Ease of download vs. file size issues**
 - **“Native” (e.g., .ppt, .doc, .xls) vs. HTML**
 - Bandwidth / network implications (answer to format issue will most likely depend on type of network technology involved and hosting method used)
 - User acceptance of (and required expertise in) various formats
- ◆ **Archival issues (and the accessing archival data)**
 - **Each update overwrites older version (saves space)**
 - **Each update is saved separately (maintains complete record of events and actions, but requires files and supporting links / files to be saved – with exponentially increasing storage requirements)**



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Global 00 - Lessons Learned: Connectivity with Remote Users



- ◆ **Utility of KW concept diminished if information producers and/or information users become disconnected.**
 - The fact that most producers and users were collocated during the game made KW use possible
 - Full connectivity necessary to allow information to be shared / linked between non-collocated sites
- ◆ **Bandwidth characteristics dictate type and sophistication of information products shared**
 - Pages often “dumbed-down” to alleviate network congestion
- ◆ **Bandwidth limitations dictated refresh rate of Summary Pages (see next page)**



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Global 00 - Lessons Learned: Information Update / Refresh Rate



- ◆ **KW was heavily reliant on manual updates:**
 - **KW updated as Functional Area Anchor Desks felt necessary – sometimes often, sometimes infrequently**
 - Method (perhaps automated) needed to ensure pages are updated appropriately
 - KW users often stated strong desire for up-to-date, near-real-time information
 - **No method (other than date / time change) to indicate updated page**
 - **Business rules for updating / confirming receipt of information inadequate.**
 - **Internet Explorer link history issues**
 - Does not reflect when link updated unless link name changes
 - Does not always accurately reflect that page has been visited
- ◆ **KW automatic refresh rate:**
 - **Game began with Summary Pages using automatic 1 minute refresh rate**
 - Received intermittent complaints that KW did not refresh quickly enough
 - **On third day of game play, automatic refresh changed to 5 minute rate in attempt to alleviate network connectivity problems**
 - Complaints increased significantly regarding refresh rate



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Global 00 - Lessons Learned: KW Hardware Resources



- ◆ **KW designed to accommodate specific applications; the addition of certain additional applications to KW computer negatively impacted performance of the wall**
 - Battlescape NT (during NDIA)
 - IWS (during NDIA and Global 00)
- ◆ **Prediction: Other graphics- and network-intensive products will further degrade performance**
 - Hardware / operating system specifications must be reviewed and upgraded on recurring basis to accommodate emerging technologies and IT requirements



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Global 00 - Lessons Learned: Other Issues



◆ Support applications

– Summary Maker and TacGraph

- Bug fixes and “user-proofing” needed
- Many recommendations for improvement (functionality)
- Numerous requests for immediate deployment!



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Global 00 - Lessons Learned: Summary



- ◆ **Improved integration of KW and other IT tools is necessary**
 - Reliance on “manual” integration of information is manpower intensive
 - From user perspective, multiple HCIs present problems
- ◆ **Method with which KW information is distributed / hosted must be redressed and optimized**
- ◆ **Connectivity issues should be resolved in the future to limit their impact on KW ConOps. Must address *bandwidth management* for distributed users.**
- ◆ **Archival and access of KW information should be accommodated (for many reasons)**
- ◆ **KW support tools (Summary Maker and TacGraph) should be improved to better support users needs**



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Global 00 - Lessons Learned: Summary



- ◆ **“Knowledge Warrior” vice “Knowledge Manager”**
- ◆ **Global 2000 highlighted need for refined business rules re: information exchange.**
 - **Advisories & Alerts**
 - **Cultural issues in Joint & Coalition environment**
- ◆ **Tools needed to reach across echelon - accommodate “distant” users of content, e.g. CJTF Summary for CINC.**
- ◆ **Role of VTC unclear.**
- ◆ **Clearly need larger desktops for content producers & key decision-makers.**
- ◆ **Common Operating Picture does *not* mean a single picture - but common databases!**
- ◆ **KW may be too big & encompassing - may want to revise CONOP to scale down to smaller workstations.**
- ◆ **Demonstrated that IT & collaboration technologies can dramatically increase “Speed of Command”**
 - **TacGraph needs to be deployed a.s.a.p.**
 - **KW & JOC of the Future CONOP substantially validated.**

Summary

- ◆ **Business Rules (and adherence to them!) make or break the Knowledge Web concept!**
- ◆ **Cross-echelon and cross-function linking and use is an important aspect of the Knowledge Web concept.**
 - **But, this has important implications for future design and use.**
- ◆ **Each user group has different needs; this implies that Knowledge Web access tools and overall concept must be significantly scalable**
 - **Other multi-user wall designs**
 - **Single-user desk designs**

The Challenge...

- ◆ **Removing the need for traditional 8-hour briefs**
 - *by providing continuous information access* –
 - implies an enormous increase in speed of command. (4X improvement? 6X? More?)**
 - **How do we take better advantage of this improvement in Speed of Command?**
 - **What implications does this have to the existing ConOps? (policies, procedures, business rules)**
 - **How do we achieve the necessary integration with existing tools and infrastructures?**



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Proposed Research and Development Efforts Needed to Extend the Knowledge Wall Concept COMCARGRU THREE & TFCC

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Command 21 - Knowledge Wall

integrated with CNAP Modernization Program video wall technology aboard USS Carl Vinson (CVN-70) May 2001



Approach

- ◆ SSC D44 to work with CCG-3 to adapt Global 2000 “Knowledge Wall” Concept of Operations & Software to meet needs of CCG-3 given existing hardware, limited availability, limited time, limited resources. ***Provide “Knowledge Engineering Services”***
- ◆ Objectives:
 - *Do No Harm!*
 - Utilize Large Screen Display (LSD) technology being installed by AIRPAC in December.
 - Explore providing additional IT-21 workstations with Multiple Displays on T-Table for additional workspace.
 - Develop CONOP for information distribution that might replace Staff Briefings.

Proposed Tasking

- ◆ **Knowledge Engineering**
 - Identify “Knowledge” Producers & Consumers
 - Identify Information Flow
 - Refine Process for sharing Information.
- ◆ **Assist CCG-3 in on-going efforts to architect a Web Site & Identify candidate content.**
- ◆ **Build Software tools to facilitate knowledge Production & distribution via web site.**
- ◆ **Support TFCC Hardware Upgrades**
 - Assess integration issues with T-Table & LSDs in TFCC.
 - Assess requirements for “Knowledge Desk”.
 - Develop prospective concepts for TFCC re-design.
- ◆ **Support Operations during Work-ups through August 2001.**
 - Collect data to assess impact of any changes.

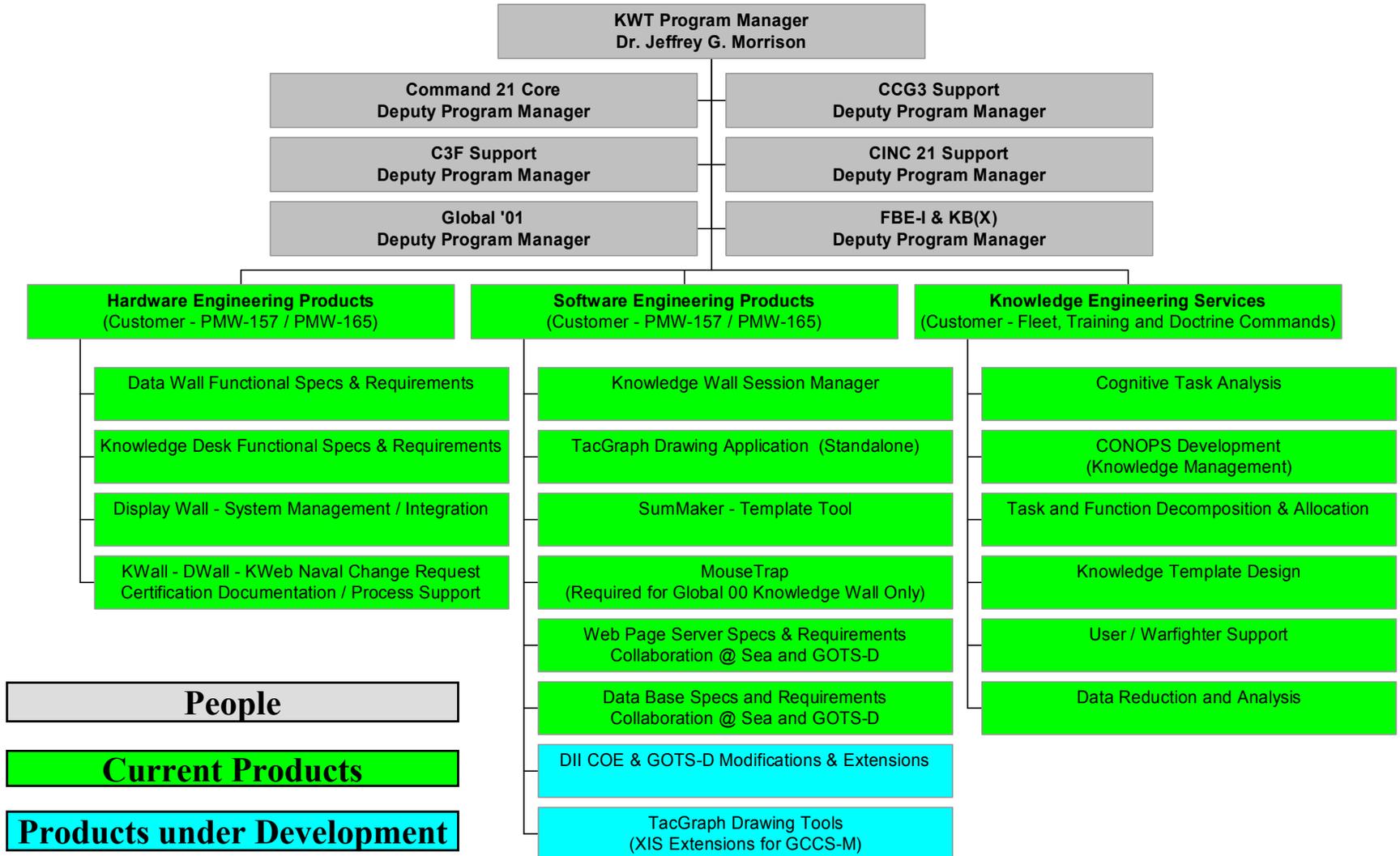
◆ Technical Risks:

- GOTS-D Waiver or Approval required for Template software, Knowledge Wall Session Manager & TacGraph tools.
- IT workstations running old service packs – not clear when they will be updated.
- Must develop re-configurable / redundancy implementation plan for any hardware / software modifications.
- Data storage / distribution mechanisms have not been defined yet; we are counting on CCG-3 to define.

◆ Programmatic Risks:

- Cannot develop implementation plan until LSD hardware procurement & installation plans are in place.
- CCG-3 is implementing “Knowledge Wall” concepts already. They are doing this with us or without us!
- Expectation Management.
- Limited Access to ship & staff.

Knowledge Web Technologies Transition Business Model





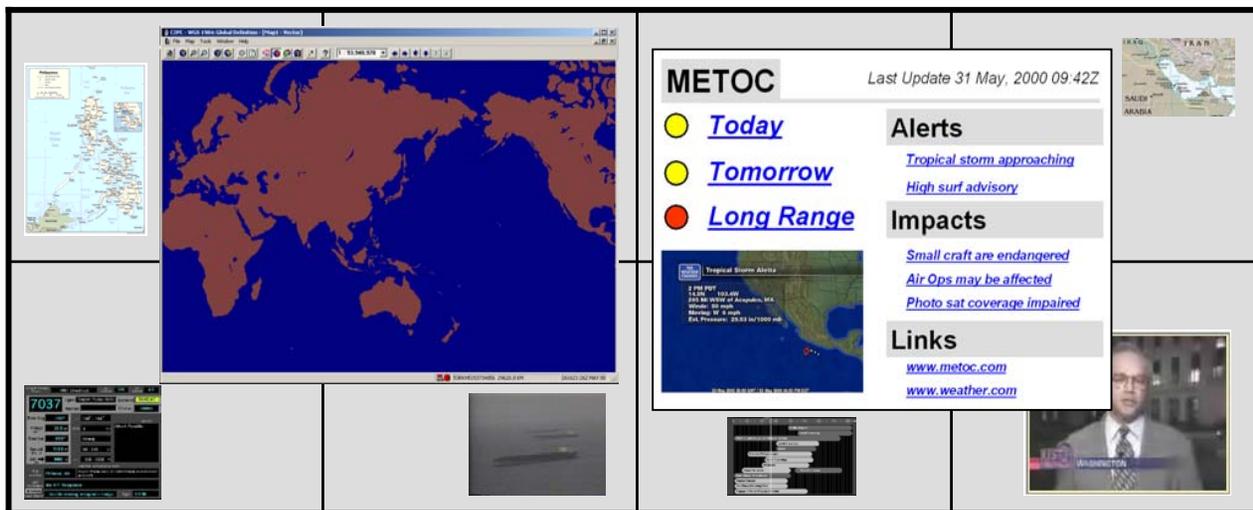
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Modified CVN-70 TFCC Knowledge Wall



Only two standard 1024 X 768 inputs may be displayed simultaneously at true / non-interpolated resolution

Single-user control



Eight 800 X 600 Cube Displays

Remaining space on cubes may be filled with smaller images – one additional input per cube

Standard 1024 X 768 images must be displayed across multiple cubes



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Potential Problems with Modified CVN-70 KW



- ◆ **Multiple users, but single-user control – other users must make configuration change requests to operator**
 - “Default” configurations must be preprogrammed into display controller – requires significant time and effort to edit default configurations
- ◆ **Full resolution 1024 X 768 images must be displayed across multiple cubes**
 - 1024 X 768 images are industry / web standard, however, only two 1024 X 768 inputs may be displayed simultaneously at true / non-interpolated resolution
- ◆ **Fewer displays – at lower resolutions than original prototype**
- ◆ **Each cube limited to two inputs**
- ◆ **Does not meet stated needs of users**
 - Easy, intuitive control of displays for shared use
 - Take advantage of web-centric Knowledge Management
 - Closely approximate Knowledge Wall used at Global '00



Answer? Mini-Knowledge Wall / Knowledge Desk



◆ Purpose

- Provide increased functionality and information access to individual TFCC staff
- Compliment (*rather than replace*) TFCC LSDs / Knowledge Wall

◆ Attributes

- Multi-headed single-user workstation to support needs of Information Consumers *and* Producers
- Variety of specialized tools to support individual tasks
- Every display at workstation supports “true” 1024 X 768 resolution

◆ Scalable Design

- Core hardware and software configurations common across desks
 - Information Consumers have 6-headed displays to facilitate monitoring and decision tasks
 - Information Producers have 2 or more displays to support information / knowledge production

Mini-Wall / Desk Design Issues *(Much work remains...)*

- ◆ **Many issues to discuss / explore**
 - **Number and size of screens**
 - **Physical layout of screens**
 - **Content and format of screens**
 - **Task support**
 - Info production
 - Collaboration
 - SA support
 - Admin functions
 - **Practical considerations**
 - Cost
 - Lab vs. ship installations
 - Usability and utility



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Current Mini-Wall / Knowledge Desk Design (For Information Consumers)



Overview Last Update 31 May, 2000 09:43Z

- Air Defense
- Deep Strike
- Effects
- Fire Coord
- Grid Control-CAS
- Info Warfare
- ISR
- Logistics
- OMFTS
- Rear Security
- Sea Control
- SDF
- Other Areas...
- [Misc Links...](#)

ISR Last Update 31 May, 2000 09:35Z

Summary

- ◆ Current Ops normal
- ◆ Sensor degraded in 48 hours
- ◆ Sensor ETR 96 hours



[Learn more here...](#)

ISR Last Update 31 May, 2000 09:35Z

Summary

- ◆ Current Ops normal
- ◆ Sensor degraded in 48 hours
- ◆ Sensor ETR 96 hours



[View ISR change history timeline...](#)

[View All Area change history timeline...](#)

Alerts & Impacts

- ◆ Sensor offline in 48 hours
- ◆ Large area of Luzon uncovered
- ◆ Maint. will require 24-48 hours
- ◆ Supplemental sensors avail.
- ◆ Change required in DSSCO
- ◆ Coalition forces unsupported
- ◆ Red aware of situation

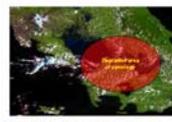
Related Info & Links

- [Mission Goals and Plans](#)
- [ISR Goals and Plans](#)
- [ISR resources and capabilities](#)
- [ROE](#)
- [Weather and propagation](#)

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Related Info & Links

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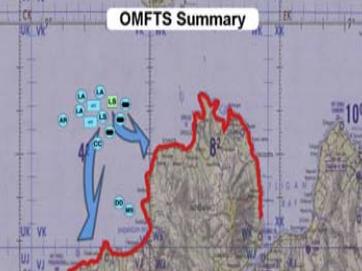
Knowledge Web
Status Displays

Multi-Purpose Collaborative Work Space

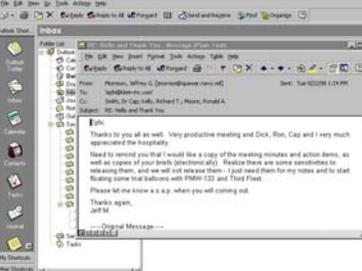
IRC, VTC, "Whiteboard," Television

LNO Status LNO Status LNO Status LNO Status LNO Status LNO Status

OMFTS Summary



Content Production Workspace



Content Production
Workspace

Communications
Access Panel
(Secure and
Un-Secure Radio R/T
Circuits)

Keyboard

Mouse Area

STU-III
Phone

POTS
Phone

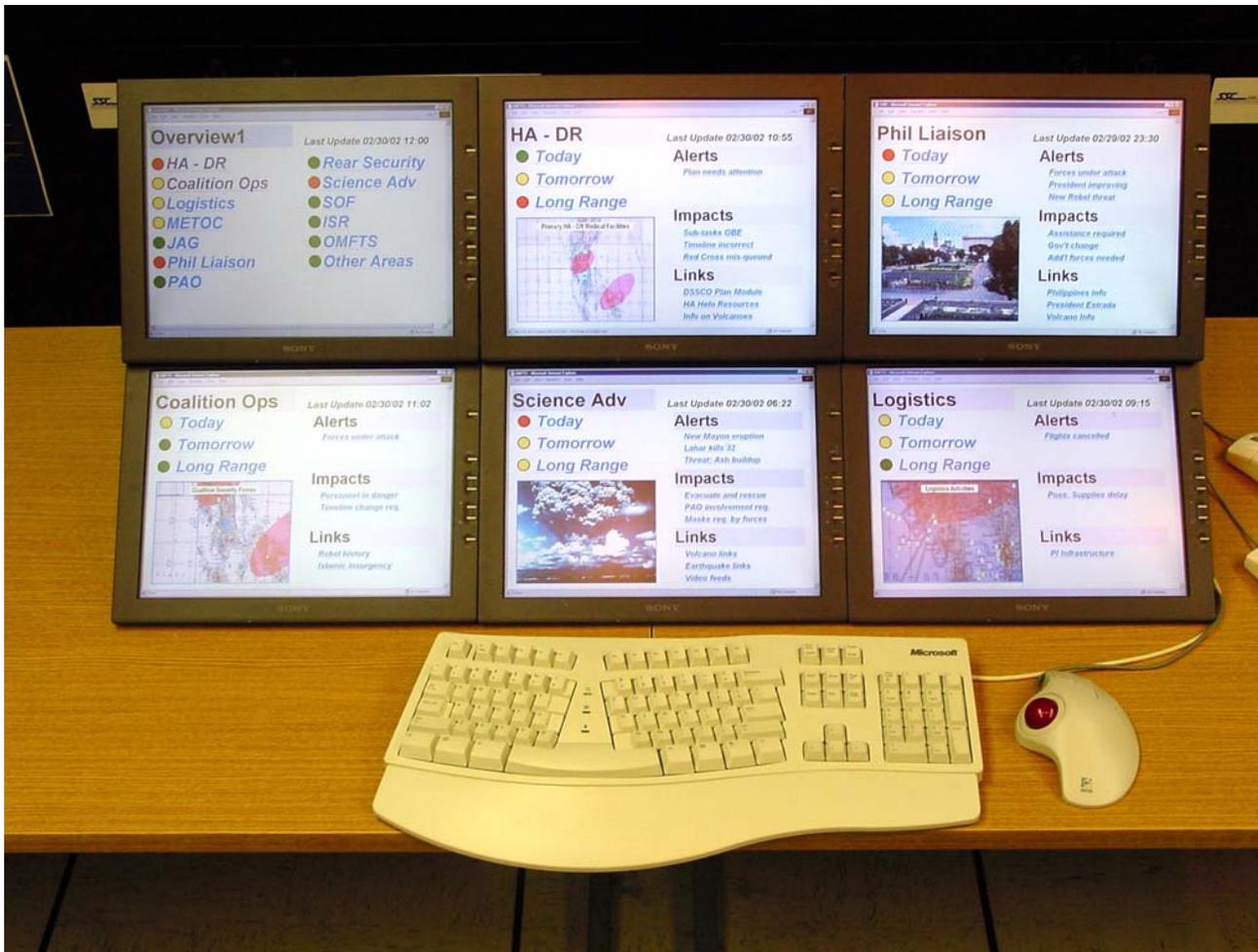


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Mini-Wall Mock-Up



Mini-Wall uses 6, 15" 1024x768 LCD Displays





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Command 21 - Knowledge Wall

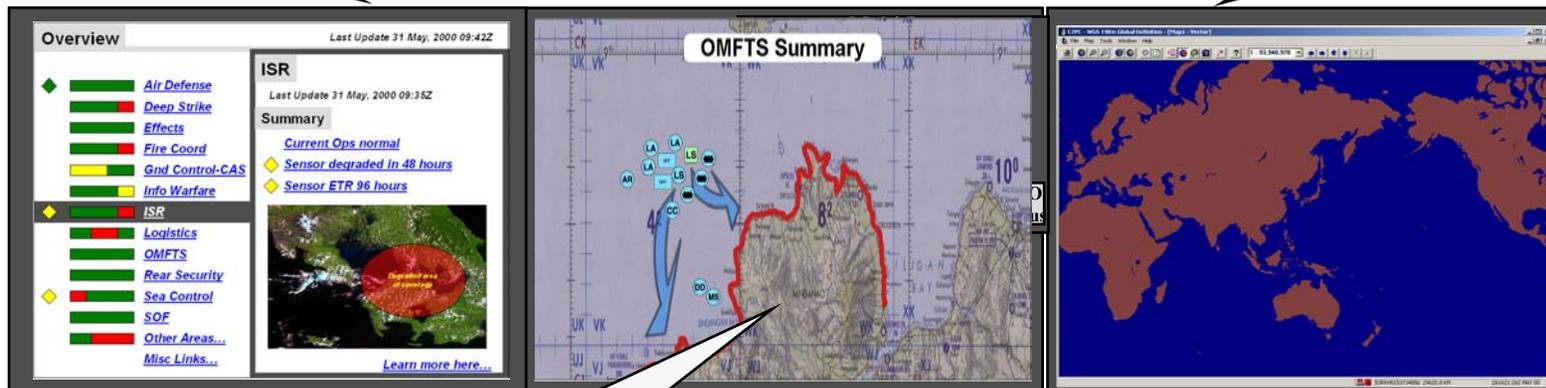
being installed at Naval War College for Global 2001



- Three standard 1024 X 768 windows may be displayed simultaneously at true resolution.
- All physical displays act as single integrated, 3072 x 768 pixel desktop.
- Single-user control of content in wall via pre-set channels.
- Touch-Screen technology & Wireless Keyboard available as control inputs to Wall.

“Knowledge Web” content
(0, 1, 2 or 3 windows)

“Tactical” content
(0, 1, 2 or 3 windows)



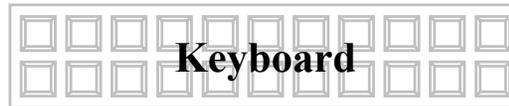
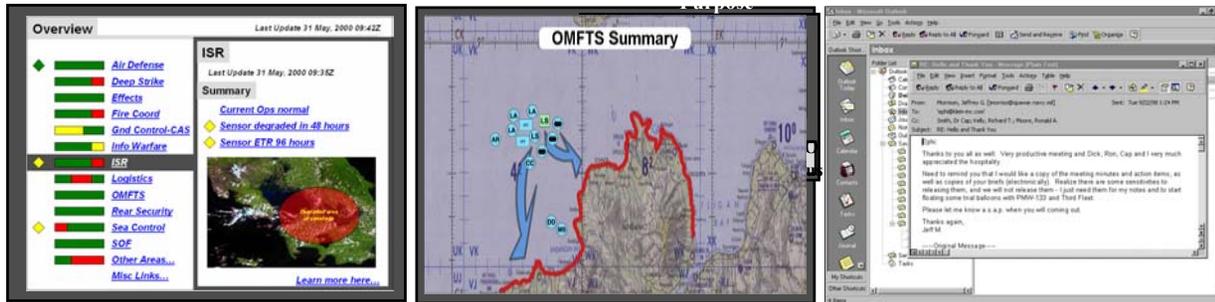
Any IT-21 based Application
(0, 1, 2 or 3 windows)

Data Wall uses
Three, 1024 X 768 pixel, Rear-Projection
SmartBoards in a 1 x 3 matrix from
single GOTS-D, IT-21 workstation.



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3-Screen Knowledge Desk Design (For Information Producers)





0 24 48 +
(Time In Hours)

- Ok
- Degraded
- Critical
- ◇ New Info

Temporally based status displays for of command (Immediate, Near, Long-Term). Linked to summary pages for functional areas

JTF

CJTF

CINC

Misc Links

Top-level summary information for the selected functional area / anchor desk

JFLCC

Last Update 03/29/01 06:15 a



Today

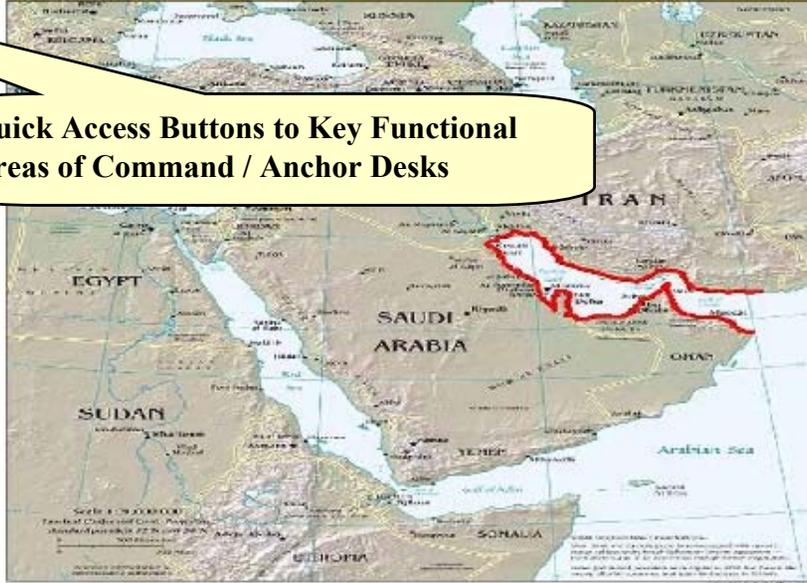


Tomorrow



Long Range

MIDDLE EAST



Quick Access Buttons to Key Functional Areas of Command / Anchor Desks

<mailto:JFLCC@global.mil>

JFLCC

Last Update 03/29/01 0

-  [Today](#)
-  [Tomorrow](#)
-  [Long Range](#)

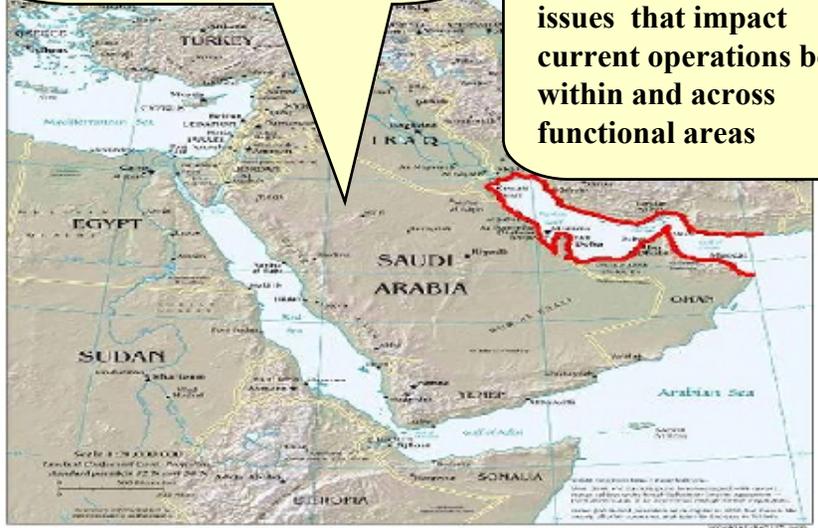
Temporally based status displays for anchor desk (Immediate, Near, Long-Term). Linked to summary pages for functional areas.

- Green = Consistent with plan
- Yellow = Issues
- Red = Show Stopper
- Diamond = Change in Status

Alerts & Impacts

-  [Encountering heavy resistance](#)
- [MARFOR holds beach 24J](#)
- [Coalition forces support EMT02](#)
- [Weather may degrade ops...](#)
- [MARFOR readiness report](#)
- [LOG delay a problem - EMT017](#)
- [Marine air support continuing](#)

Multi-Use area provided for presentation of summary graphic / multi-media / text



Critical problems and issues that impact current operations both within and across functional areas

Related Info & Links

- [Rules of Engagement](#)
- [Order of Battle](#)
- [IW / PSYOP Plans](#)
- [Recent MARFOR RFI's](#)

Reference material relating to problems and issues being worked at this anchor desk

<mailto:JFLCC@global.mil>

Direct Link back to author desk via e-mail

CJTF

Last Update 03/29/01 06:37 a

- [Today](#)
- [Tomorrow](#)
- [Long Range](#)



Alerts & Impacts

- [Ops proceeding as planned](#)
- [Casualty rate < expected](#)
- [Civil Affairs report avail.](#)
- [Weather may degrade ops...](#)
- [SLOCs opened](#)
- [COMM Plan revised](#)
- [VTC rescheduled](#)

Related Info & Links

- [Rules of Engagement](#)
- [Order of Battle](#)
- [CCIRs](#)
- [PIRs](#)

<mailto:CJTF@global.mil>

CINC

Last Update 03/29/01 07:00 a

- [Today](#)
- [Tomorrow](#)
- [Long Range](#)



Alerts & Impacts

- [SOJ Operation under control](#)
- [ROK HA-DR Plan completed](#)
- [Pacific Rim Leader Conference](#)
- [Hurricane headed toward Japan](#)
- [Major eruption in Philippines](#)
- [Spratley Islands Update](#)
- [SCS oil spill predicted effect](#)

Related Info & Links

- [Presidential Policies](#)
- [NCA Guidance](#)
- [Pacific Disaster Center](#)
- [PACOM Resources](#)

<mailto:CINC@global.mil>



Primary FAs

Last Update 03/12/01 11:05 a

[CWC](#)

[METOC](#)

[Intel](#)

[Air Defense](#)

[Maritime Ops](#)

[Strike](#)

[Info Warfare](#)

[Force Protect](#)

[Air Ops](#)

[Carl Vinson](#)

[2nd Level FAs](#)

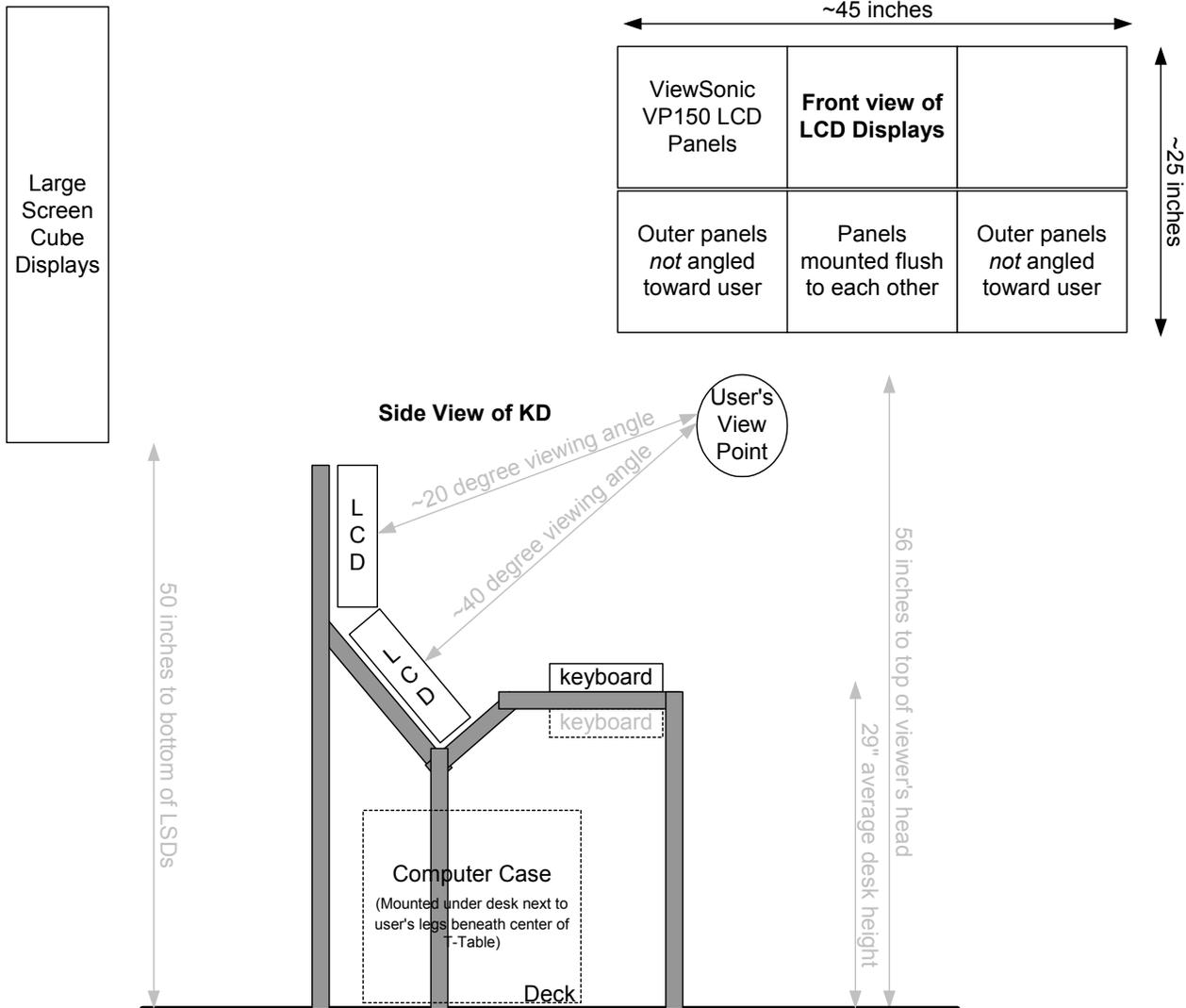
[Misc Links](#)



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Mini-Wall / Desk Side View

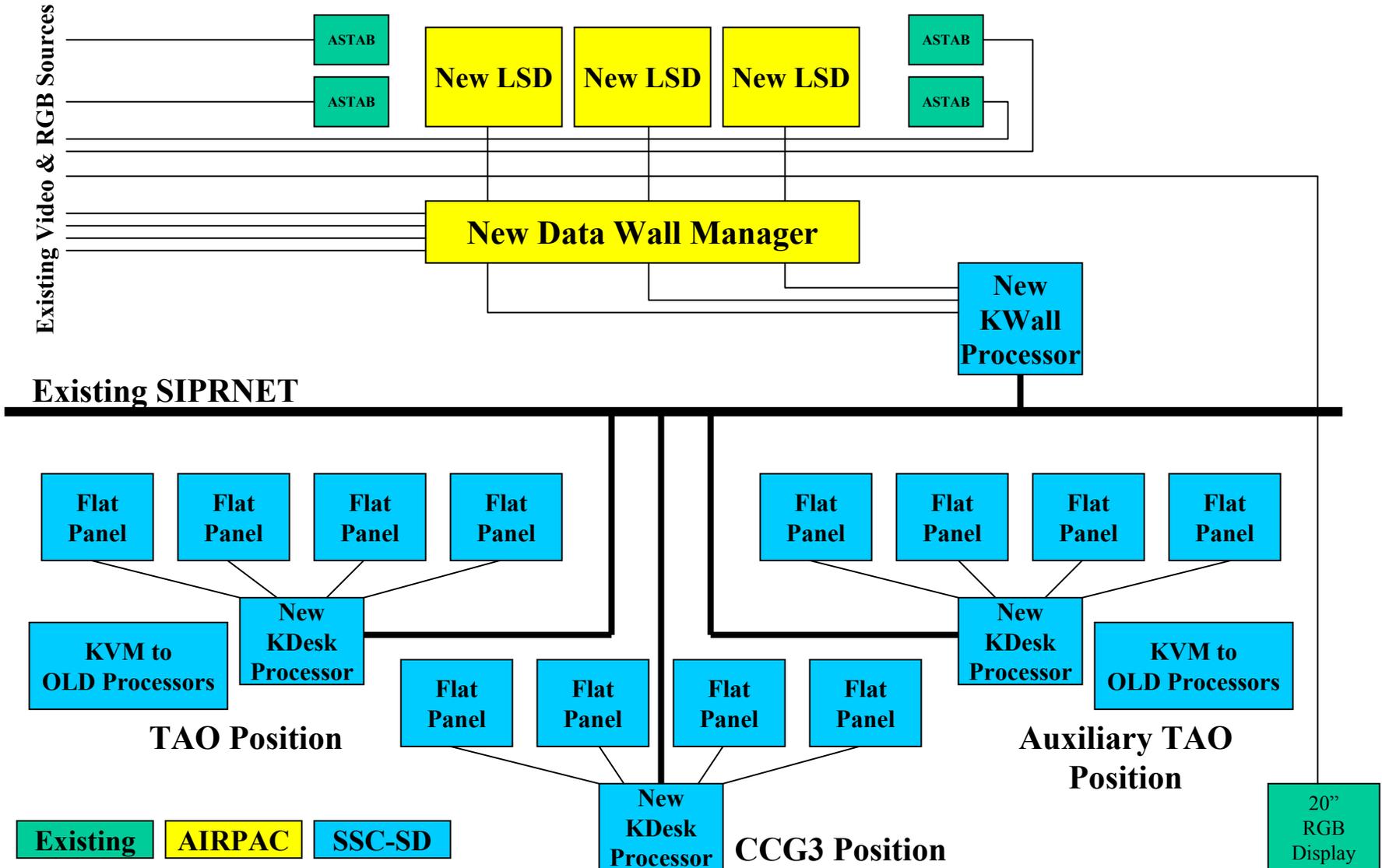




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USS Carl Vinson TFCC Upgrade

Phase 2



Conclusion

Command 21 Knowledge Wall:

Exploring the implications of Network-Centric Warfare on the *Speed of Command*

Based on world-class science

Empirically tested,

Fleet Validated.



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