A Multi-Disciplinary Approach in Building Effective Command Centers

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Background

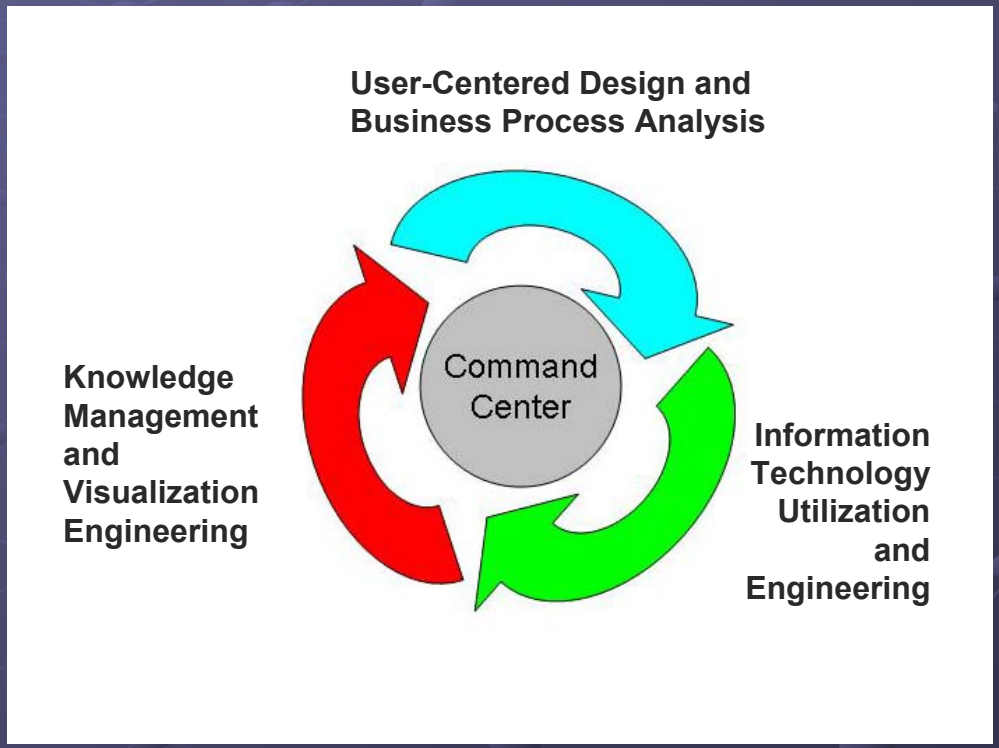
- Command Centers
  - Have been integral part of warfare throughout the ages
  - Have evolved in recent years in conceptualizing, designing, engineering, and deployment
  - Pose unique set of challenges from human interaction to information technology
- Command Centers are technology driven, information source intensive, and workflow process dependent
- Effective design must entail ongoing and iterative collaboration among multiple disciplines
- Multi-disciplinary approach to address the ongoing challenges

Approach

- Model that has been followed entails
  - Requirements, Design, Specification, Development, Integration, Testing, Deployment, and Maintenance
  - Variations to this known model may include the waterfall, incremental, and spiral development
- Not a linear process or “checklist”
  - Various disciplines must be carefully introduced during all phases
  - Blending a number of best practices in support of a multi-disciplinary approach

Development Categories

- Command Center Development Approach
  - Physical Structure
  - User-Centered Design and Business Process Analysis
  - Information Technology Utilization and Engineering
  - Knowledge Management and Visualization Engineering



Physical Structure

- Three primary situations identified
  - Develop from the beginning
    - Provides flexibility for planning and specification
    - Enables integration of other disciplines into initial process
  - Rehab an existing facility
    - Possibly successful but with constraints and boundaries
    - Modify requirements to successfully integrate into existing facility
    - May limit full optimization of key disciplines
  - Design a command center that is mobile
    - Limit of functionality due to mobility requirements
    - Complex information technology challenges
- Physical Structure is an important first step in bounding the problem for other disciplines

User-Centered Design (UCD) and Business Process Analysis

- Users must be involved in the development of the Command Centers
- User-Centered Design
  - Perform cognitive task analysis to understand requirements of users
    - Users take part in workshops/meetings answering questions regarding product functionality; major tasks are identified
    - User information is then used to develop a prototype (paper, drawings, software shell)
    - Prototype is then tested by users in support of their task and UCD engineers will make the necessary changes
    - Iterative process with engineers and warfighters to develop command centers
  - Validate work iteratively and minimize the gap between requirements gathering and product delivery

UCD enables warfighters to develop command center products that best meet their needs

Human Factors Engineering

Improve Work Flow, Collaboration and Group Dynamics

Provide operational evaluation of innovative concepts

- Collaboration, coordination, and connectivity
- Common operational pictures
- Time-sensitive decision-making
- Cross-echelon, consistent situation understanding

Information Technology and Engineering

- Information technology products must facilitate
  - Coordination of personnel, communications, planning
  - Controlling forces to accomplish an operational mission
- Most challenging information technology issues that must be addressed
  - Technology refresh
    - Rapid changes to fielded technology
  - Technology integration
    - Software and hardware
- Designers must understand both available technology and specific user requirements

Knowledge Management and Visualization Engineering

- Warfighters must have access to the necessary information
- Four areas for effective knowledge management (KM) and visualization engineering
  - Data management
  - Data integration
  - Data correlation
  - Information visualization
- Retrieval of data important but quality of data is key
  - Accessing data at multi-level security levels
  - Effective sorting of key information
- Data correlation to build decision trees
- Visualization of information to determine the next course of action (COA) by the decision makers

Knowledge Management and Visualization

Improve Situational Awareness, Understanding, and Decision Making

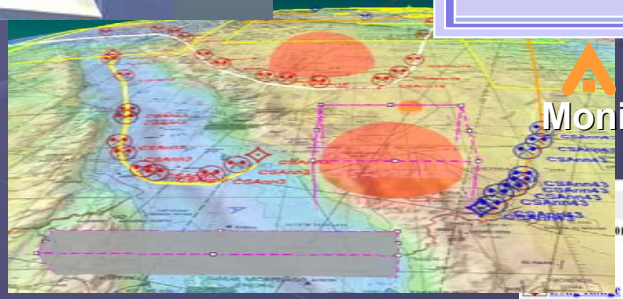
State of the Environment

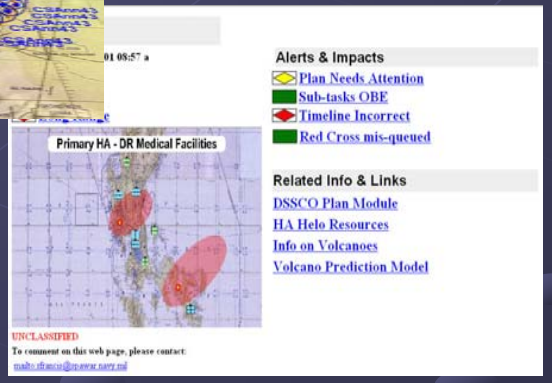
Goals | Experience

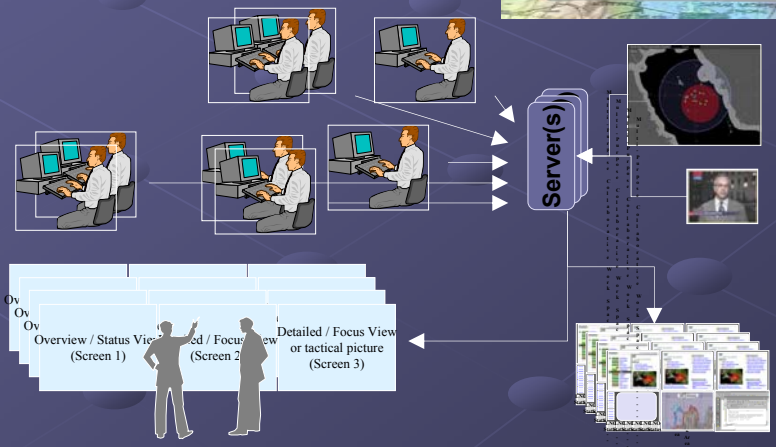
SITUATION AWARENESS

LEVEL 1	LEVEL 2	LEVEL 3
Perception	Comprehension	Projection

Monitor | Integrate | Predict







Integration of Disciplines

- Command center development entails various factors and disciplines
  - Physical Structure
  - User-Centered Design and Business Process Analysis
  - Information Technology Utilization and Engineering
  - Knowledge Management and Visualization Engineering
- Starting point is typically structural
- Structural compromises must be made
- Utilization of disciplines throughout the process
  - Introduce all disciplines early in the process
  - Not just physical structure or information technology
  - Iterative process using every applicable discipline

Success Stories

Command Center Development

CENTCOM Deployable HQ

- Very rapid development for CENTCOM
- Currently deployed in Qatar
- 25 shelters: size of football field
- 230 watch positions
- SCI, Secret, Unclass, and Coalition nets
- Provided overall technical direction, expertise (>100-work months)

Nimitz–MacArthur Pacific Command Center

- System engineering for C4I systems
- Design and implementation
- Crisis and day-to-day operations
- Advanced displays
- Multi-level network services
- Flexible connectivity to all work positions
- Onsite operational support

Nimitz–MacArthur Pacific Command Center

HQ21 C4I Functional Areas

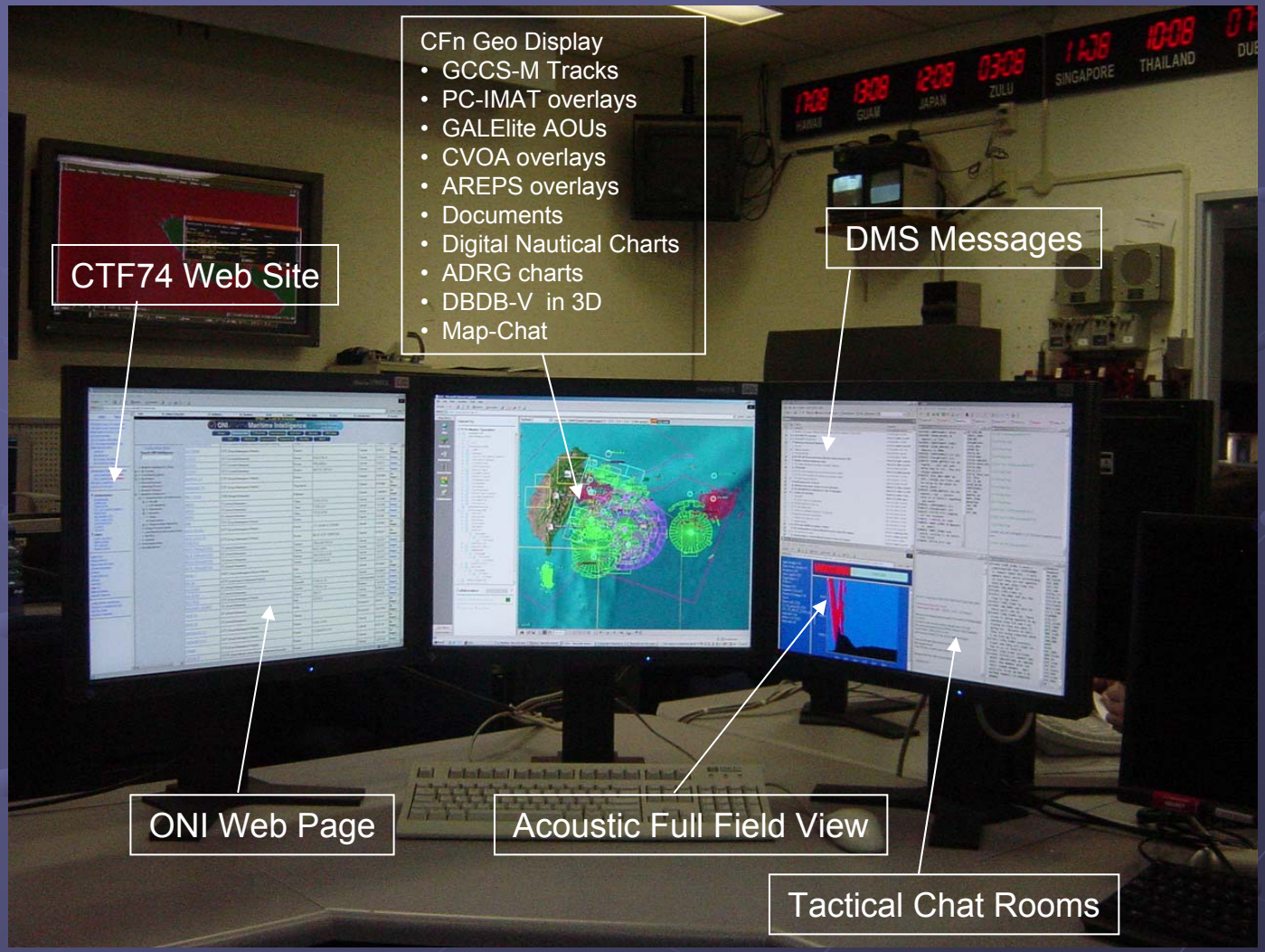
- **Tech Control—GENSER circuit management, includes ATC**
- **J2 ITSO (not pictured)—Intel circuit and network management**
- **RF/SATCOM—satellite connectivity**
- **Backhaul Cabling (not pictured)—cable plant to connect to other bldgs**
- **Telecoms—admin telephone, DRSN, and terrestrial (WAN) connectivity**

Nimitz–MacArthur Pacific Command Center

HQ21 Functional Areas (cont)

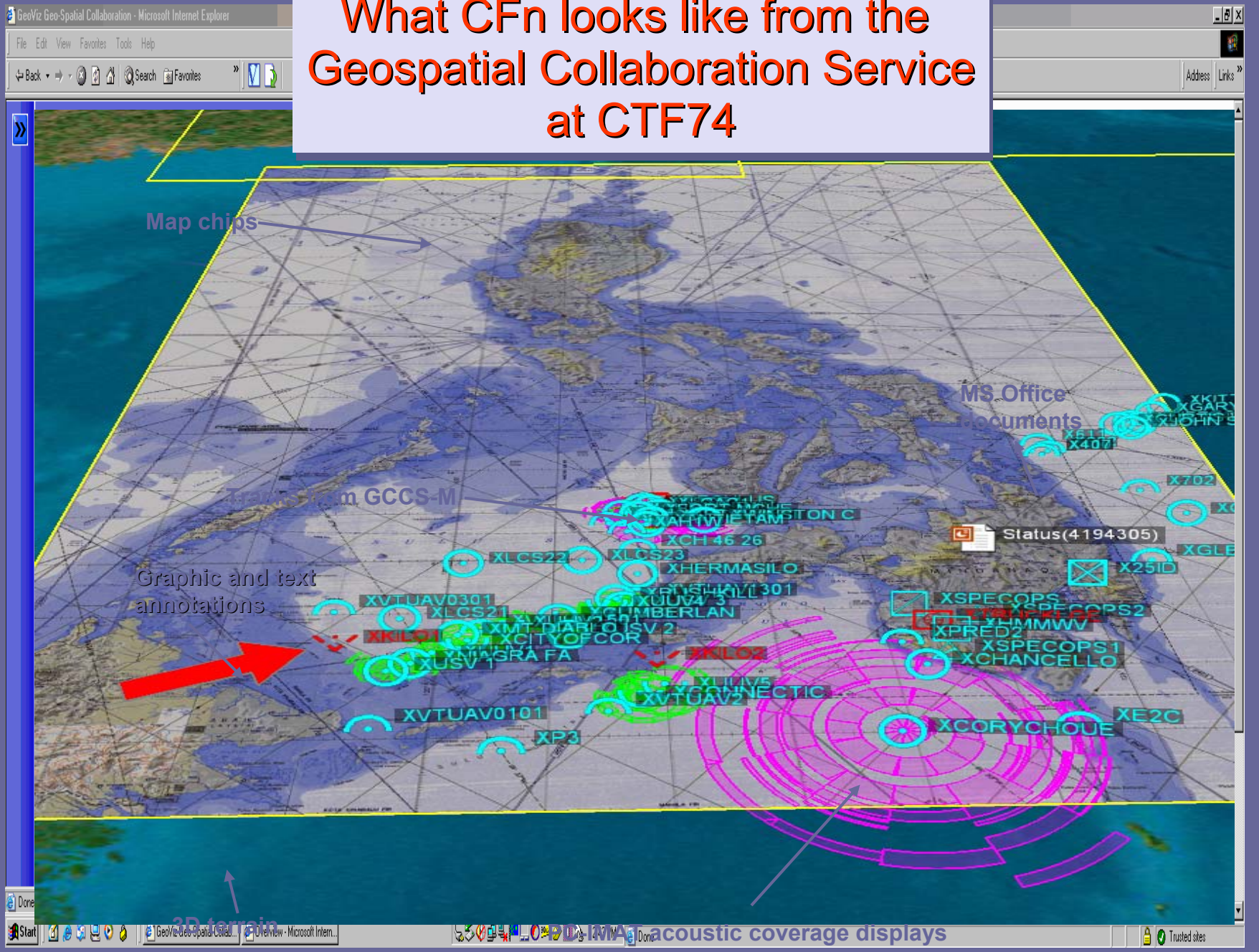
- **JOC: Crisis management; provides Battle Staff decision-making info; uses all C4I assets including national C2 systems**

TASW CFn Battle Watch Captain Display at CTF 74



CFn Web based C2 provides improved understanding

What CFn looks like from the Geospatial Collaboration Service at CTF74



Conclusion

- Command center development can be challenging
  - Command centers are technology driven, information source intensive, and workflow process dependent
  - Effective design must entail ongoing and iterative collaboration among multiple disciplines
- Apply various disciplines into the development process
- Command Center development approach
  - Physical Structure
  - User-Centered Design and Business Process Analysis
  - Information Technology Utilization and Engineering
  - Knowledge Management and Visualization Engineering
- Integrate disciplines iteratively with warfighters and engineers

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