Intelligent Collaboration and Visualization
A Key Element of the ITO Human-System Integration Strategy

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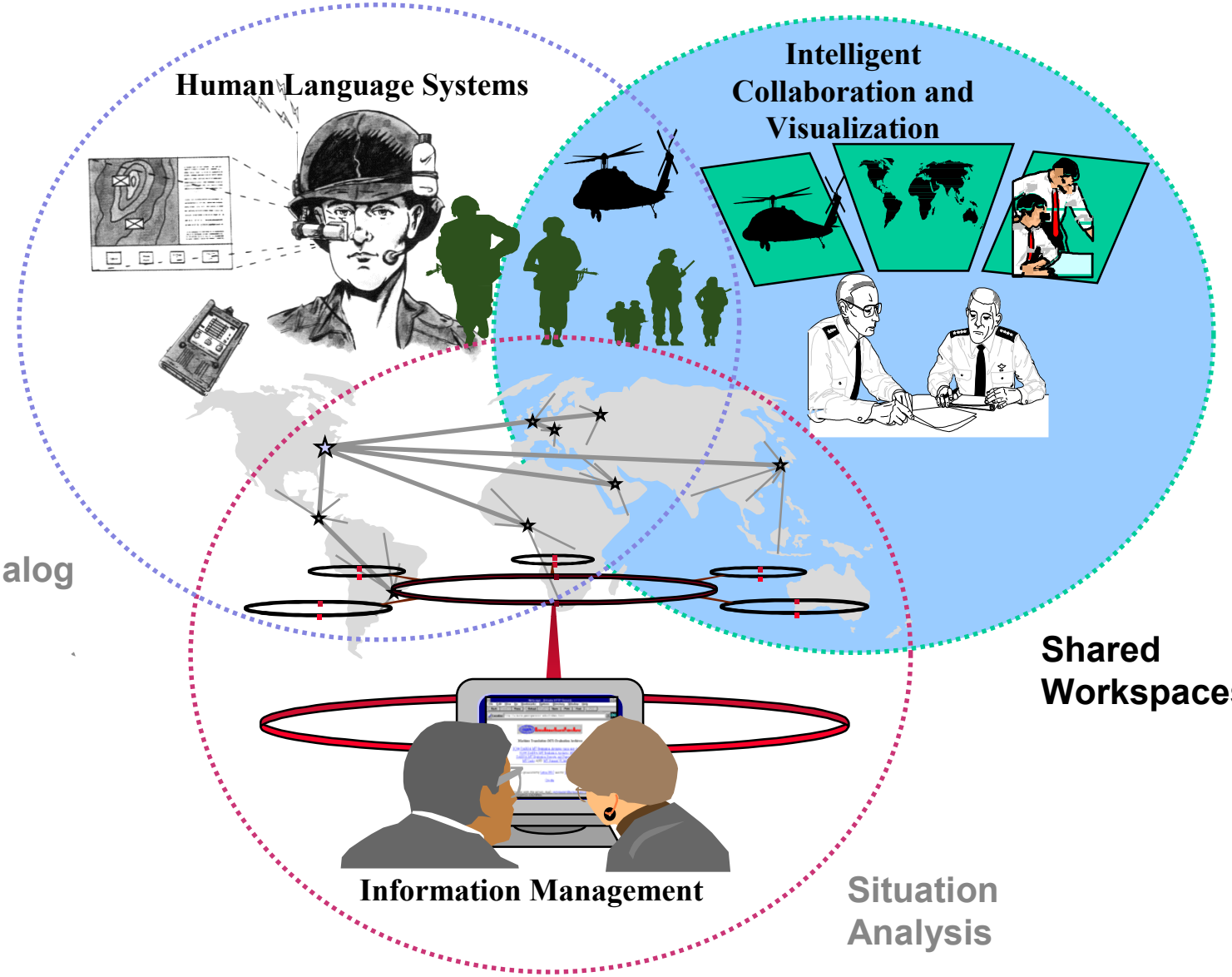
Pgm No.: CEX3E
Pgm Mgr.: Mills
PAD No.: 970086



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Software that organizes teams in rapidly changing environments and helps those teams organize and access their information resources.

Adaptive Session Management

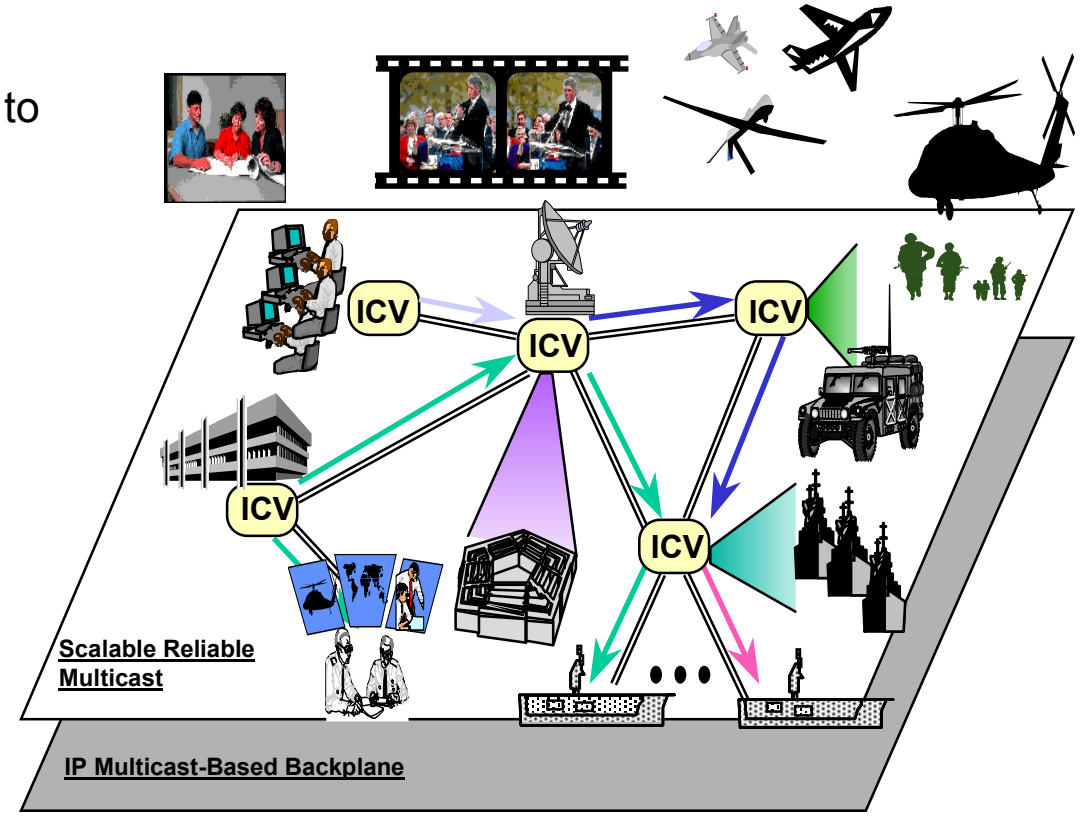
- Adapt Real-time Multi-media Sessions to Situation, Task, and Team
- Compose Virtual Shared Workspaces
- Enable Collaborative Use of Legacy Applications

Semantically-based Tools

- Record and Index Multi-media Collaborative Sessions
- Discover and Connect Relevant Information and Collaborators

Team-based Visualization S/W

- Link Visual Workspaces
- Explore Multi-modal Collaboration



Evaluation Methods, Metrics, and Tools

Intelligent Collaboration and Visualization

Project Emphasizes Transitionable Technology

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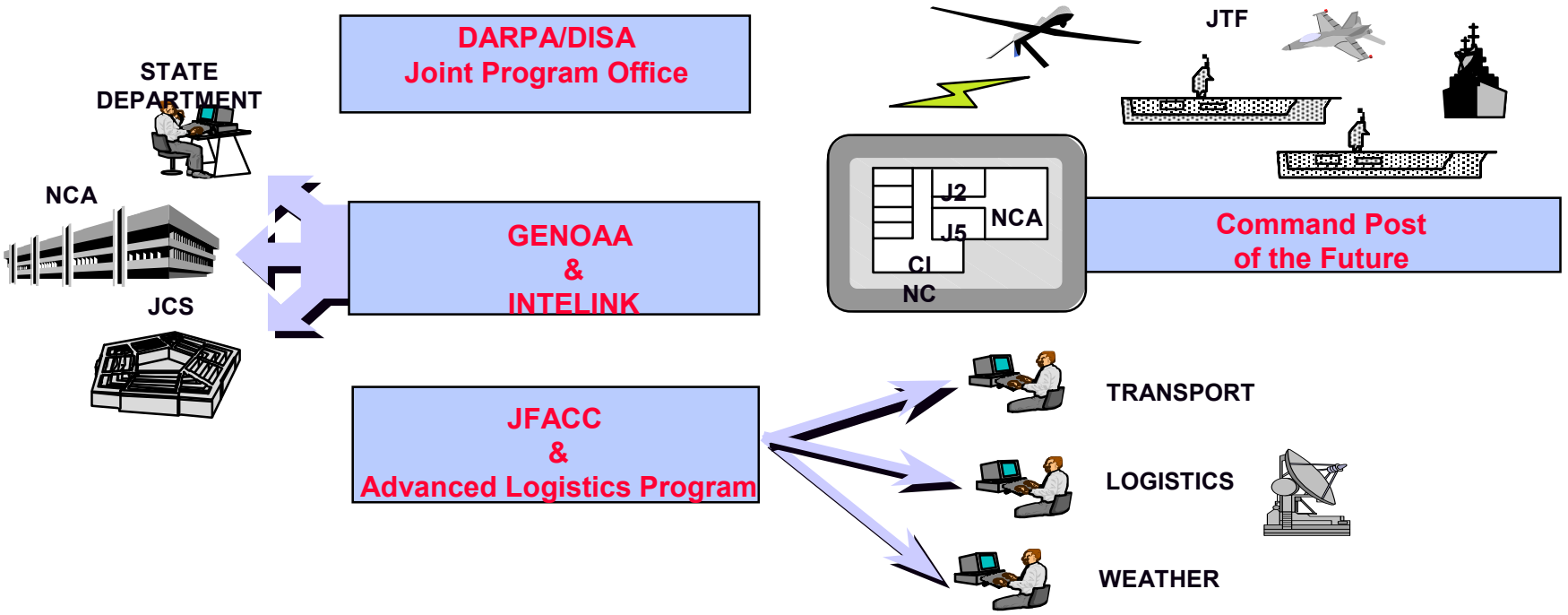
MILITARY TARGETS



COMMERCIAL TARGETS (working through International Data Corporation)

Major Players

Microsoft
Netscape
IBM Lotus
Novell
Oracle

Placeware
Open Text
Instinctive
Radnet
Precept

Startup Companies

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Link Visual Workspaces

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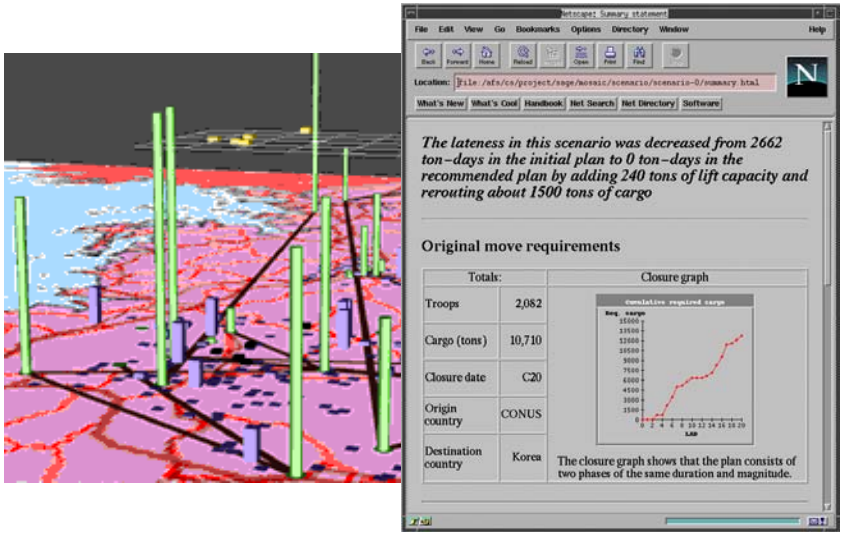
VISAGE : Automatic Visualization Design, Explanatory Briefings & Data Exploration



Carnegie Mellon University, Univeristy of Pittsburgh, and MAYA Design

- Enable computer programs to provide users with the best representation for the data, given a task, and to help users to visually explore, analyze, and explain data
- Develop knowledge-based rules for generating 3-D graphics and for adapting graphic generation to display capabilities
- Develop methods to automatically generate text explanations coordinated with automatically generated graphics

Transition Success

- Visage selected as the visual workspace by five ISO programs (ALP, Genoa, DMIF, JFACC, and CPoF)
- JPO, ISO, and ITO planning a strategy to harden Visage and to enable military programs to immediately benefit from the fruits of further, Visage-related research

New Research Directions

- The **Autobrief** project will extend the SAGE automated graphic designer to include an explanation generator so that graphics and related textual explanations can be produced automatically.
- The **Visage-Link** project will extend the Visage scripted-frame technology to support distributed, linked visual workspaces among collaborators.

Intelligent Collaboration and Visualization
Adapt Real-time Multi-media Session to Situation, Task, and Team

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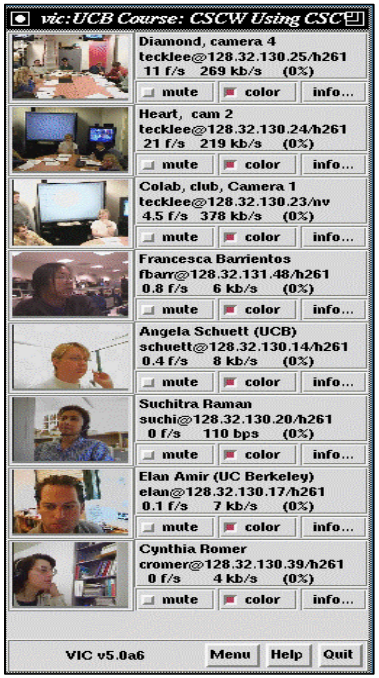
MASH: Multimedia Architecture that Scales across Heterogeneous Environments

- Provide a scalable architecture that enables multimedia conferencing among hundreds of thousands of users across heterogeneous environments
- Develop an active multimedia object architecture, based on scalable reliable multicasting, to permit shared control of time-varying visualizations
- Develop session management algorithms to control resources, to perform real-time transcoding, and to coordinate teams

University of California, Berkely



Transition Plan

- **MASH Toolkit** will replace previous generation multi-cast, multi-media conferencing tools (I.e., vic, vat, and wb) used in many DoD applications. **Alpha release available 9/97**.
- Integration contractor, BBN, identifying suitable customers. **Beta release available 5/98**.

Research Results

- **SCUBA** - Algorithm to monitor activities of conference participants and adapt fixed b/w to reflect semantic activity in the session.
- **MeGa** - A transcoding video gateway that enables conferencing among participants with heterogeneous displays and bandwidths without defaulting to least-common traits.
- **Mediaboard and Active Objects** - Enables collaborative control of time-varying visualizations.

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Explore Multi-Modal Collaboration

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DISCIPLE: Distributed System for Collaborative Information Processing and Learning

Rutgers University

- Devise and explore innovative user interfaces specifically designed for collaboration in multimedia environments; integrate graphic object extraction techniques and speech-recognition technology
- Develop knowledge-based rules for trading-off object down-loading vs. remote execution, for assigning tasks to resources, and for compressing communications based on context

Research Results

- **Prototype Integrated Multi-Modal Interface** - Integrates gaze and gesture tracking, unencumbered speech recognition, and speech synthesis to produce more effective human-computer interface.

Research Plans

- **Single-Machine Integrated Multi-Modal Interface** - Move the technology from a three machine basis to a single-machine basis.
- **Knowledge-based Resource Allocation** - Based on monitoring semantic events in a collaborative session, develop algorithms to manage conference resources, such as b/w and CPU resources, floor control, microphone state, and camera positions.

Evaluation Plans

- Working with CECOM and BA&H, apply the MMI to a command and control application

Intelligent Collaboration and Visualization
Record and Index Multi-Media Collaborative Sessions

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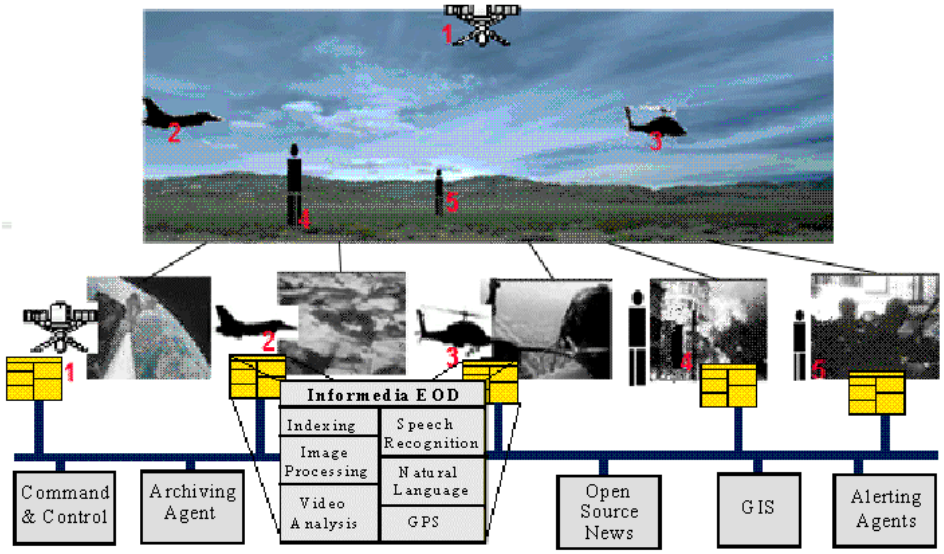
Experience On Demand: Capturing, Integrating, and Communicating Experiences Across People, Time, and Space



- Capture multi-sensory experiences from individual points of view; integrate and index those views for semantic access
- Develop an experience-on-demand (EOD) information system to capture, analyze, organize, and manipulate audio, video, and GPS information from mobile EOD units
- Apply acoustic, speech, and natural language processing together with image processing for scene analysis and object detection to extract, filter, and organize information from multi-sensory sources into segmented episodes

Carnegie Mellon University

Research Challenges

- Analyze unbounded continuous media with decreased data quality and episodic segments
- Move from words as primary information and indexing source to image/audio and position (GPS) interdependence
- Enable multi-dimensional, multi-modal queries and results that can integrate multiple perspectives

Current Research Activities

- Building devices to enable continuous capture of all modalities (sight, sound, time, location)
- Experimenting with speech isolation/recognition in noisy domains and with assembly of composite/panoramic view from multiple personal views
- Developing database algorithms for large-scale spatial joins and query optimization across modalities and for mixed media data mining

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Evaluation Methods, Metrics, and Tools

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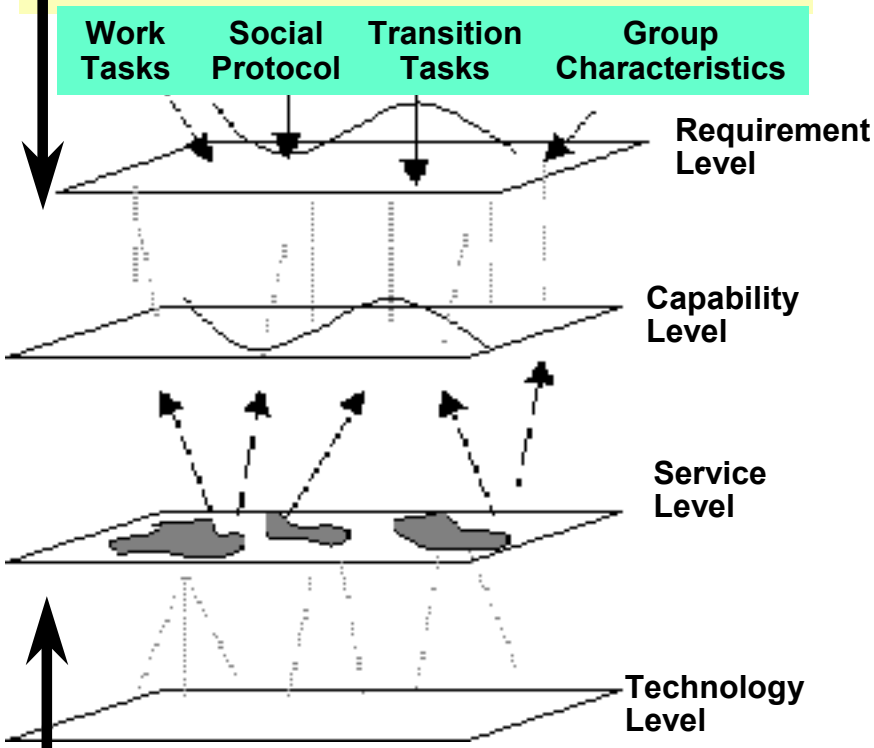
What tools are needed?

Requirements define needed capabilities, which map to specific services etc.



What a system is good for:

Technology/services support capabilities which enable different tasks, kinds of groups,..

Research Results

- **Developed Four Level Collaboration Technology Model** - Provides two-way path from needs to technology and from technology to needs.
- **Developed Multi-media Logging Tools** - Distributed to IC&V researchers. 12/97

Research Plans

- **Refine Collaboration Technology Model** - Add metrics, requirements, capabilities, and services.
- **Define Standard Logging Formats** - Engage IC&V researchers to ensure that logged sessions can be exchanged.
- **Test Evaluation Methods, Metrics, and Tools** - Evaluate selected IC&V and commercial collaboration technologies.

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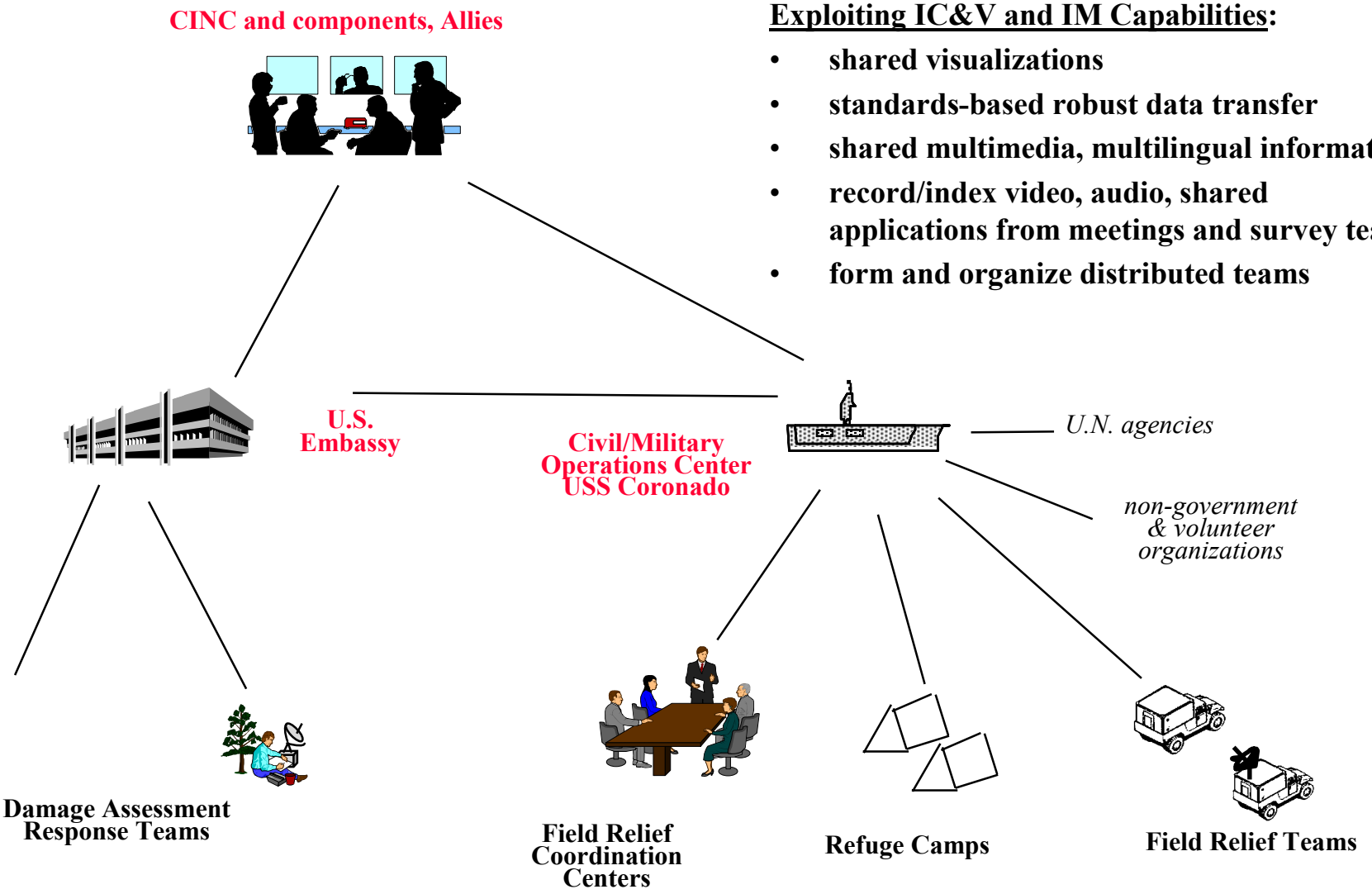
Pacific Command Disaster Relief Scenario



Exploiting IC&V and IM Capabilities:

- **shared visualizations**
- **standards-based robust data transfer**
- **shared multimedia, multilingual information**
- **record/index video, audio, shared applications from meetings and survey teams**
- **form and organize distributed teams**

Expected Results

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Early military adopters derive near-term benefits from specific IC&V technologies, while industry delivers future collaboration technology based on DARPA research and development. Such technology will:

- **Adapt session resources based on semantic demands of the participants, as inferred from automated monitoring of activities.**
- **Provide semantic access to automatically indexed multi-media archives of collaborative sessions.**
- **Automatically identify and route relevant information to collaborators in real-time.**
- **Link interactive, visual workspaces among distributed collaborators so that visualizations share common and related, but different, behaviors.**