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

MILITARY TARGETS

DARPA/DISA
Joint Program Office

GENOAA
& INTELINK

JFACC
& Advanced Logistics Program

Command Post
of the Future

COMMERCIAL TARGETS (working through International Data Corporation)

Major Players
Microsoft
Netscape
IBM Lotus
Novell
Oracle

Start-up Companies
Placeware
Open Text
Instinctive
Radnet
Precept
Intelligent Collaboration and Visualization

Link Visual Workspaces

VISAGE: Automatic Visualization Design, Explanatory Briefings & Data Exploration

Carnegie Mellon University, University 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.
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

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.
**Intelligent Collaboration and Visualization**

**Explore Multi-Modal Collaboration**

**DISCIPLE: Distributed System for Collaborative Information Processing and Learning**

- 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 downloading 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

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

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
Intelligent Collaboration and Visualization
Evaluation Methods, Metrics, and Tools

What tools are needed?
Requirements define needed capabilities, which map to specific services etc.

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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.
Intelligent Collaboration and Visualization
Capstone Demonstration

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

CINC and components, Allies

U.S. Embassy

Civil/Military Operations Center
USS Coronado

U.N. agencies

non-government & volunteer organizations

Damage Assessment Response Teams

Field Relief Coordination Centers

Refuge Camps

Field Relief Teams
Intelligent Collaboration and Visualization

Expected Results

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.